VOL. III. JANUARY 1913 No. 1

AMERICAN JOURNAL OF PUBLIC HEALTH

HEALTH DEPARTMENTS AND HOUSING.

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Read before the National Housing Conference, December, 1912, Philadelphia, Pa.

The most common reason for neglect, by officials or citizens in any community, of housing reform measures, is their lack of apprehension that bad housing exists in that community. No health officer is well advised in 1912 who does not know that it has now been demonstrated that every city or town of sufficient size to have organized health control is already infected, to a greater or less degree, with the deadly virus of the slum. Whether his community be an industrial city, a traffic center, a college town, or a river village, he has only to look for housing evils to find them. The duty of every health officer to discover the bad housing in his city or town is an obligation which cannot be dissociated from other official responsibilities.

BAD HOUSING (Lovejoy) consists in "Houses that are

(a) Poorly lighted,
(b) Unventilated,
(c) Damp,
(d) Imperfectly drained,
(e) Exposed to undue fire peril,
(f) In bad repair,
(g) Vermin infested,
(h) Disease infected,
(i) With uncleanly surroundings,
(j) With insufficient water supply,

(k) Without toilet accommodations adequate for comfort, cleanliness and privacy,
(l) With defective plumbing,
(m) With overcrowded rooms, and
(n) With cellar tenements."

Such Houses are

"Dangerous to moral and physical health, social and personal, and Promote

(a) Industrial inefficiency,
(b) Inebriety,
(c) Dependence,
(d) Poverty,
(e) Disease,
(f) Death,
(g) Juvenile delinquency,
(h) Debased citizenship,
(i) Vice and crime,
(j) Degeneracy of race."

The *prevention* and *cure* of bad housing conditions must proceed along three lines:

I. Every *new* dwelling and tenement *must* be constructed as to *afford suitable living accommodations;*

II. Every *old* house *not* now *fit for habitation must* either *be demolished or improved* so as to become fit;

III. *All habitations, new* and *old*, must be *maintained in good repair* and *sanitary condition.*

It is our purpose to inquire with what weapons health authorities, especially municipal health officers, may engage in active warfare against the brood of housing evils, and what places in the line of battle they should take.

1. Standards for New Houses.

The important standards required for new houses depend upon the application of physical laws and established principles of hygiene. Some of these laws and principles are based upon the common knowledge of intelligent persons and others depend upon the experimental confirmation of hypotheses.

The prescribed sizes of rooms are based upon observations of the extent to which the contained air becomes vitiated by the presence of a number of persons in a room during a given time and the opportunities for change of air in the room through leakage of its walls and ceilings or through window or door openings.

The standards for window design are reasonably determinate and depend both upon the natural laws which govern the transmission and absorption of light and our observation of the actual illumination produced under various circumstances.

At the present time most of the standards prescribed by housing law are to a degree empirical and practical rather than scientific. They are, however, continually in process of modification and strengthening by each day's observation of their application and actual use in buildings.

The time has come when the provisions now in effect governing the size, lighting, and ventilation of habitable rooms in tenements should be applied also to living rooms in other classes of dwellings. This has not been done, so far as I am aware, except in the Chicago Building Code of 1911, in which section 274 sets the same standards for living rooms in all classes of buildings.

The health officer, while not posing as a court of last resort in certain of these matters, should be qualified by his training and experience to demonstrate the advantages which result from the use of such standards, and should, moreover, be willing to participate cordially in the framing of laws in which these standards are embodied.

He may be sure that no effort in housing advance will result in such lasting reward as the successful expression of health standards in the structure of new habitations.

2. The Improvement of Unfit Dwellings.

The improvement of a house unfit for habitation mainly consists in structural changes in the framework of the building and in its plumbing and drainage equipment.

In extreme cases of deterioration it becomes necessary to reconstruct floors and roof and sometimes parts of the outer walls. Such vital repairs and replacements ought to be prevented by the requirement of law that no dwelling which has become damaged by fire or otherwise to the extent of half its value or more should be reconstructed.

In most cases, however, the actual replacement of defective portions of the structure is limited to new joists and floor in the lowest story and piece-meal repairs elsewhere, including some rearrangement of partitions and replacement of old plumbing. In no city outside of New York, in cases of repair involving 20 per cent. or more of the cost of a house, should living rooms be allowed unless each such room has a minimum floor area of 70 square feet and is provided with a good window opening to a suitable open space.

With respect to plumbing, it may be said in a general way that soil and waste pipes more than twenty-five years old will not be found free from

grave defects in design and jointing. Most plumbing fixtures over fifteen years old, especially water closets, will be unfit for further service. The drainage system of an old building, unless its integrity can be proven, should be replaced.

The changes described are expensive and will often be resisted by the owner as unnecessary and unjustified, especially if the tenants are of the unthrifty sort who make a bad house worse by neglect and abuse. To enforce laws under these circumstances of opposition the converging efforts of building, legal and health authorities are required to make a clear demonstration to the owner and sometimes to judge and jury that community degradation results from bad housing.

3. The Demolition of Unfit Dwellings.

Slovenly shacks and ramshackle shanties, tumble-down sheds and tottering stables, dwellings in disreputable disrepair, "shame-stained and bearing the nauseous odors of decay," disfigure our cities to an unnecessary extent.

The health authorities who realize the nuisances and social dangers that result from the existence of such structures may and must take the initiative in community movement for their destruction.

The Board of Survey in Chicago is composed of one Medical Inspector, one Sanitary Inspector and one Building Inspector, and has, during the past four years, accomplished only meagre results. There were 94 buildings demolished in this period and 43 repaired. The principal reason for such small accomplishments is the fact that the Board is composed of men who are busy in their respective departmental duties and is not provided with any assistant who can devote his time continuously to the examination and condemnation of buildings.

For some years past the Board of Health of Boston, through Chief Inspector Jordan, has devoted attention to the demolition of entirely unfit houses and of such lean-to and rear extensions of houses as have been found doubly undesirable from both health and structural viewpoints. The total number thus razed during the past eleven years, varying with the meagre appropriations available for this use, is 1,138, or an average of 103 per year.

A third example of such activities is the remarkable work done since 1907 in Washington, D. C., by the Board for the Condemnation of Unsanitary Dwellings, resulting in the tearing down of 1,503 houses unfit for habitation and the thorough repairing of nearly as many more. This unprecedented result has been achieved through the active coöperation of Doctor Woodward, health officer, with his colleagues on the Board, and is in part due also to the steady employment on this work of Inspector Haynes, whose energy and tact has stimulated the work of the Board and the courts.

The clean-up of our cities and towns by the tearing down of unsightly and unfit houses will in general depend upon the appointment of some discriminating employee whose sole business it shall be to look up such cases, determine the extent of deterioration and issue authoritative notices requiring prompt repair or demolition. He must have power, if such notices are not complied with, to raze the buildings without protracted process of law.

4. The Relation of the Health Officer to the Maintenance of Houses.

While the coöperation of the health officer is required in the design and building of new houses and the reconstruction of existing ones, the keeping of both new and old, within and without, in fit condition for habitation, is particularly his province. His ceaseless function is the exercise of practical sanitation and instruction in its tenets to owner, agent and tenant.

This means patient, tactful, tireless enforcement of the laws which prohibit overcrowding, unclean accumulations, the presence of horses, pigs and goats, the occupation of unfit cellars and attics, etc., as well as the affirmative provisions that the house, its surroundings and all its parts, especially its plumbing and drainage, shall be kept clean and in good repair.

The means for accomplishing these results consist in

(a) An adequate inspection service acting upon its own initiative as well as upon complaints.
(b) A sufficient office force.
(c) An individual record system for each home.

These tools of administration must be supported by prompt courts and active prosecutors, upheld in turn by a sympathetic public opinion.

A Trained Inspection Force.

The best method of selection (Civil Service examinations) will give only untrained inspectors, some of whom will have been clerks, some carpenters, some plumbers, etc. This raw material must be made into a homogeneous force of inspectors by a systematic school of training which will relate to

(a) The purpose and history of housing reform,
(b) Their attitude toward the public and toward other officials,
(c) The general duties they have to perform,
(d) The laws they are to enforce,
(e) The methods of making records.

A properly graded force will consist of chief inspector, deputy chief, supervising, verification, special and district inspectors, including some women inspectors.

The Office Force.

The office force should consist of a chief clerk, correspondence, reviewing, complaint, file and personnel clerks, stenographers and typists.

Records.

Card reports written in the field on prepared blank forms are now recognized as the most advantageous kind of inspector's records. These should be specially designed for certain lines of investigation, as for new tenements, basements, overcrowding, plumbing, etc.

With respect to organized methods of housing inspection and control it may be said that the highly organized tenement house department of New York City exemplifies interesting details not yet applied in other departments.

5. Periodical House to House Inspection.

There is no city of 100,000 or more population, and probably none of 50,000 which does not contain a few blocks at least where the housing conditions will never be cured by occasional piece-meal applications of any remedy. As already intimated, it will not do to treat these areas by the time-honored but antiquated method of inspection on complaint.

Mr. Veiller has well said: "In place of this casual, haphazard method there must be substituted the only system of sanitary inspection that is worthy of the name. Instead of sitting calmly waiting for complaints, health inspectors must systematically go about 'looking for trouble'—they will find plenty. Instead of sending a man to look at one thing in one house, because it is complained about, there should be a well-trained corps of men going over every part of the homes of the poor, systematically and thoroughly, scrutinizing carefully every part of the building where trouble might naturally be expected—all the probable danger points."

In Chicago it is estimated that there are more than 1,000 city blocks which should be thus "combed" at least twice or thrice annually. In 1909 we were able to canvass once over only 100 blocks; in 1910, 120. Alas, our hitherto proud accomplishments, standing next to New York and Boston in this regard, have now lapsed into innocuous desuetude, for in 1911 we were able only to canvass 25 blocks, and in 1912, only 17.

6. The Prevention of Overcrowding.

The question of room overcrowding is to be given full consideration at a later session, but it is worth while to note here that no effective measures of detection and prevention of this insidious evil are in force except in two or three cities to a slight extent.

A noteworthy example in this regard is the work done by the medical health officer of Liverpool, Eng., with respect to overcrowding in sublet houses. Tabulated statements for ten years past show that the number of such houses registered has fallen from 22,488 in 1904 to 18,800 in 1911. The night visits for the detection of overcrowding, not less than 17,000 in any year of the past ten, reached its maximum of 23,534 in 1909. The number of convictions for overcrowding, 1,351 in 1901, decreased to 414 in 1910. Such activity as this our American cities can well emulate.

This menace to both health and morals will not, it seems to me, be checked until we are able to overcome our prejudice to the entrance of inspectors at night and are willing to surrender something of the freedom of the home. Authority of law must be had for posting on the walls and entrances of suspected rooms a permanent placard stating the maximum number of persons who may lawfully occupy the room in question and the penalty which is to be incurred for crowding above the specified limit. Such a notice would be observed and violations noted by police and health inspectors, nurses, etc., but would also be advice to the owner, lessee, tenant, and, no doubt, as well, to parish priest, probation and truant officers, settlement residents, and to any person likely to care to check this evil.

I know that a law authorizing such posting of rooms would have little hope of passage in Chicago at present because of the lack of apprehension of the evil to be cured and the cry that it would violate the sanctity of the home of the poor man.

7. The Control of Contagious Diseases in the Tenement.

If every other reason was lacking to stimulate the interest of health authorities in housing reform, increased incidence of contagious diseases, due to close contact of the members of a family in low, small, crowded, ill-ventilated and dirty rooms would be a sufficient argument for their attention.

Speaking of this, Commissioner Young says: "We exclude from school all cases of contagious diseases when we discover them. What do we do when we exclude them? In about 86 per cent. of the diphtheria cases the cry comes back, 'We have no place to stay at home. There are two or three or four children and we live in two rooms, or two rooms and a kitchen. What shall we do with the other children?'" In the City of London in 1911, 85 per cent. of diphtheria cases were cared for in hospitals; in Chicago 15½ per cent.; of scarlet fever patients, 90 per cent. in London; 7 per cent. in Chicago. For all active contagious diseases London has provided about 6,400 beds, New York about 1,800, and Chicago about 425.

Mr. Health Officer, is it not true that isolation, cleanliness and uncon-

taminated food are impossible for the members of a family living in a congested tenement home? Is it not hopeless to expect hospital facilities sufficient to provide for the removal of every child, sick with diphtheria or scarlet fever, from its home to a hospital bed?

Add to these considerations the exposure to infection which occurs so frequently from the common use of toilet facilities by the sick and well, and often by members of two or three different households, and the wonder grows, not that many are made sick, but that any escape the inroads of contagion.

8. The Abolition of the Privy Vault and Outside Toilet.

If health departments do not cry aloud against the privy vault, this ancient evil, not alone of the congested city but of sparsely settled neighborhoods, little protest will be heard from other officials or residents. All sanitarians, however they may differ as to their methods of disease control, agree that hygiene, decency and convenience alike demand the abolition of the privy vault and its next of kin, the outdoor water closet. If vaults must exist because of lack of sewerage facilities, health officials are in duty bound to prescribe and control methods of construction and maintenance such as are least likely to injure the health of the community.

Where necessary to be provided, privy accommodations may be either of three kinds of construction:

(a) Small and shallow metal pans or pails set on an impermeable platform above the level of the ground;

(b) A tight barrel buried not more than three-fourths of its height in the ground; or

(c) A tight masonry vault projecting at least 8 inches above the ground surface.

Whatever the receptacle, it must be surmounted by a fly-proof, ventilated shelter house.

To do away with all vaults at the earliest date the health officer must early and late urge the need of extension of the sewer system into all unsewered territory, and when sewers are available he must see that plumbing is provided and the old-time depository forever banished.

9. The Collection of Household Statistics.

The problems of housing are to be solved as all other important questions of social welfare are to be answered by scientific inquiry as to the facts involved.

The collection and arrangement of the statistics which prove that a bad house is a menace to those who dwell therein is a service to housing reform which must be rendered, if performed at all, by health departments.

Just enough data has been collected to show the value of housing studies, but with respect to many of the effects of bad housing we can only say "we do not know." We lack clear, scientific, affirmative proof.

Let us determine the relative mortality of infants born in tenement rooms and those born in good rooms. Let us show the deviation from normal standards of the little children in overcrowded homes. Let us compare the relative size, weight and strength of children who reach the legal age of employment from families belonging in crowded blocks with others in uncongested neighborhoods. Let us tabulate the prevalence of filth diseases in tenements and in single dwellings. Let us count the deaths in hovels and compare them with the deaths in decent homes. If we would learn the possibilities of health in normal housing conditions and of long life for all men we must collect such facts as these. When such comparisons can be accurately presented it will not take long to do away with the ancient and modern evils of the slum.

10. Health Publications and Housing.

The most effective factor in the program for good housing will be an informed, alert and exacting public opinion; hence, the most important of all considerations is the matter of education.

Reports or bulletins are now published by about 35 State Boards of Health and 70 city health officers. These vary greatly in educative value. Some consist in statistical tables only; some contain valuable results of scientific investigations; some, however (and the number is increasing), follow the lead of Dr. Frank W. Reilly, who, as Assistant Commissioner of Health of Chicago in 1894, began the publication of health information in popular form.

Up to the present, references to housing in regular reports and bulletins are meagre and rare. So far as I am aware none of the special bulletins devoted to a single subject, as tuberculosis, small-pox, typhoid fever, pellagra, etc., has treated of housing. Surely the importance of housing reform and the material now obtainable will justify its consideration as a subject for publications of this kind.

11. Limitations of Health Activities Caused by Weak Laws and Small Appropriations.

As I look over this audience, I recognize the faces of men who stand in the front rank as health administrators, and whose devotion to the cause of housing reform is evidenced both by their presence here and the services they have rendered. These men will say that some things that I have set forth as desirable are now impossible because of two limitations of their efforts:

1st: The lack of power to enforce laws;

2nd: The limited appropriations made for health purposes.

It is lamentable to discover how little real authority to enforce laws has been given by legislatures and city councils to health officers. Sometimes it almost seems that the purpose of the law is to protect the one who is maintaining a nuisance against the rightful demand of all the other people that the nuisance be abated. The power of summary abatement is quite lacking in most of our cities.

Most health laws are framed on the theory that no steps can be taken to anticipate and head off disease, but that action can only be taken to cure existing evils after they have become fully developed. This is all true, but the action of progressive health authorities will be hampered less and less by antiquated laws, and the speed of advance will depend upon the urgency with which they press the necessity of changes upon reluctant lawmakers and prosecutors.

The increase of health appropriations from twenty or thirty cents per capita to one dollar will come only after public opinion is aroused to a due appreciation of the economy which will result from preventive health measures. Health officers can forward this movement to some degree, but this advance will mainly depend upon other classes of workers represented in this conference.

12. Conclusion.

I picture in my mind's eye a city in which the babe, yet unborn, will feel in its being the stimulus of sunshine and fresh air; in which the infant will be born into a house fit to receive a gift of heaven; in which the child will never know the burden of the slum, but through normal development will come to manhood ready joyfully to do his share in the work of the world and qualified to assume a worthy citizenship.

Having such a forecast in mind let us not be satisfied until we have made it take substance.

ROOM OVERCROWDING AND THE LODGER EVIL.

LAWRENCE VEILLER,

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Read before the National Housing Conference, December, 1912, Philadelphia, Pa.

It is rather humiliating after seventy years of effort at housing reform in America to confess, as we have to confess, that one of the most serious housing evils encountered in any country has not been grappled with and that practically no plan for its solution has as yet even been proposed.

Embarrassing as such an admission is, we must, however, in all fairness, frankly confess that, so far as the great problem of room overcrowding goes, there has been no serious attempt made in America to cope with it nor any rational plan for its solution heretofore presented.

Moreover, we are seemingly without accurate information as to the extent of the evil. There exist only vague impressions, based upon individual cases which have come to the attention of imaginative journalists or sympathetic social workers, although it is to be hoped that some light will be thrown on this subject by the investigation made by the Congressional Committee on Immigration some two years ago, the results of whose work are now in process of publication in some forty-six volumes.

Just how great an evil *is* room overcrowding in America? Is it merely a New York condition, or do we find it manifesting itself in other American cities, and has it become a serious evil in those cities? Further, is it an evil found only in cities? May we not find it even in small towns and villages, and possibly even on the open prairie?

The most picturesque accounts that we have thus far heard are of two episodes that have become very familiar. They give promise of being repeated with as much persistency as the old familiar fable of the coal in the bathtub.

One is that highly flavored incident of the newspaper reporter finding four families keeping house in one room with chalk lines dividing off the floor into four parts, only the width of the chalk line separating family from family.

The other is the less frequently repeated story, but one with probably a far greater basis of fact, of the "Box and Cox" arrangement, by which rooms in many houses are occupied by double shifts of workmen, one group sleeping in the rooms and beds by day, the other by night. More valid testimony than such sensational instances afford, is obtained from social workers, especially from those living in settlements; from them we learn

of numerous individual instances of small apartments occupied by a large number of people. The instances thus reported are generally, however, isolated ones, chanced upon in the course of neighborhood visits. Whatever the scientific accuracies or inaccuracies of the testimony at hand, the range is certainly wide. One case of thirteen people in one room in a small shanty on the prairies of Indiana would seem to mark the extreme limit of the manifestations of this evil.

With regard to one fact, all observers are agreed: That the evil of room overcrowding is manifested chiefly among certain elements of our alien population; the Italians, the Poles, and Russians, and the later immigration of Slavonic races. We do not hear of many accounts of it being encountered with the Irish, the negro or our own poor whites, although individual cases among all these races have come to our attention.

We are similarly without accurate facts as to the causes of this evil. One group in the community tell us that it is due entirely to economic conditions; that it is a direct result of poverty; that it is caused by the high rents which the poor have to pay and that they are forced by need to take in lodgers to eke out their scanty income. On the other hand, many observers are of the opinion that in the majority of cases it is not so much need as greed; that it is not due to dire necessity so much as it is to the desire of certain elements of our alien population to add penny to penny, dollar to dollar, with the greatest rapidity, and who care little how they live in their feverish race for money. We are also told that, instead of these conditions being the result of high rents, they are the cause; that the landlord, finding that his tenants are making their rooms a source of income by letting out a portion of them and taking in lodgers, makes up his mind that the rooms will bear an increased rental and accordingly raises the rent; this, in turn, causes the tenant to take in more lodgers to meet this increased rental, and later, the landlord, finding that the rooms are affording a still further increased revenue, proceeds again to raise the rent, and so on, to what might be termed the limit of elasticity, beyond which the tenant's purse cannot be stretched.

The writer believes that there is truth in both of these views; that in many cases room overcrowding is undoubtedly due to need; that the low earning capacity of the family, the uncertainty of employment, the sickness of the wage-earner, in a word, a variety of social and economic causes, do make it necessary for many of our poor people to eke out a scanty income by this means. It is the easiest and surest method at command for increasing the family income.

On the other hand, so far as the writer can judge from his twenty years' observation of life among the poor, this evil is caused far more by greed than by need; by the desire to rapidly acquire money than by the necessity for increasing the income.

I attribute it also to a third cause, namely, racial solidarity. This is a factor in the situation which heretofore has not been sufficiently considered.

Room overcrowding as we know it in America is almost entirely wrapped up with the lodger evil. It is seldom due to the large size of the family, contrary to the popular impression; the cases of overcrowding due to the large family are so seldom met with as to be negligible. Were there no other manifestations of room overcrowding than the few cases of large families in small quarters that are encountered, housing reformers might well give no further consideration to the problem.

The real evil lies in the practice of taking outsiders into the family life, either as lodgers or boarders; generally single men of their own race, frequently from their own village, men who have come to this country, as many of our foreigners come, only to better their industrial condition and who, while they are here, intend to save every penny that can possibly be saved, denying themselves every comfort in order that they may return in a few years to their native land with a small competence with which they may be able to set themselves up as "landed proprietors."

The taking in of lodgers is frequently an act of help and aid to a fellow-countryman. The better established workingman thinks back to the time (not many years ago) when he was in a similar position, a stranger in a strange land, ignorant of the language of the country and unfamiliar with the industrial opportunities before him; a prey to every unscrupulous person who would profit by these handicaps. It is not strange, therefore, that he should be anxious to aid the friend, or the cousin of a friend from his own village, who, starting like himself, a young man, has come to this land of promise to make his fortune.

But it is not all friendship. The mutual advantage makes its appeal. The ordinary tenement dweller sees in the opportunity of taking in a lodger an increased income; a relief in meeting the tremendous burden of rent, the one fixed charge that cannot be evaded, which must be met at a regular date. Even a dollar a month looms large. The benefit is immediate and concrete; the ultimate cost is remote and unconsidered. Of course, we should frankly recognize that no matter how sympathetic the ordinary workingman is, he is not going to take a fellow-countryman into his family and keep him for nothing for any considerable period of time. It is, therefore, a commercial proposition with him, as well as a sentimental one.

I am led more and more to the conclusion that it is primarily this element of racial solidarity, coupled with the obvious financial advantage and augmented by the lack of proper housing accommodations for the newly arrived single immigrant that we must regard as the basic factor in our problem of room overcrowding.

So much for the causes; now, as to the effects of this evil. Here, too, we are singularly without accurate information. We have been told for

years that the practice of taking outsiders into the family life is fraught with serious evils to the community; evils of a physical, moral, civic, social, industrial and economic nature. That this is so, I, for one, have no doubt. We should, however, be better equipped for the attack if we had a more certain basis of accurate data at our command. All that we can rely upon, however, is the appeal to reason. From the very nature of things the results of room overcrowding must be of this kind and the ordinary person at once grants this without the necessity of arraying a series of incontrovertible facts to prove our case.

There are, of course, in the experience of the social workers of the country innumerable individual instances where the moral effects of room overcrowding are strikingly illustrated, where the introduction of strange men into the family life has led to the breaking up of homes, to the separation of husband and wife, to the going astray of young daughters just emerging into womanhood.

So far as the physical effects of room overcrowding are concerned, we have at hand considerable information, the results of studies made in Great Britain and other countries, showing the increased deathrate, the lesser height and weight, and the less developed physical condition of children reared in one room than of those reared in two rooms, and similarly the less advantageous condition of those reared in two rooms than those reared in three rooms, and so on. I, for one, feel hesitation in basing arguments on these conclusions. To me it simply means that the investigators have found what any intelligent person could have told them in advance they would find. It does not require scientific investigation nor special wisdom to realize that a higher deathrate, greater industrial inefficiency and inferior physical condition will be found among the poorest elements of the community, who, because of their poverty, can only afford one room to live in and that often the poorest kind of accommodation to be found in the city; that their children should compare unfavorably with the children of families whose economic position enables them to live in more commodious quarters is not a matter of surprise.

May it not be that they live in one room because they are poor and weak, not that they are poor and weak because they live in one room?

With regard to the civic effects of room overcrowding, we are on sure ground. The social worker is in a position to observe every day in the year the bad results from this kind of living; the serious effect it has upon good citizenship; how difficult it becomes for the person living under these conditions to have an interest in the welfare of the city.

The bad social effects of this method of living are only too easily observed. It can hardly be called living; it is merely existence and nothing more. In the words of Doctor Russell of Glasgow:

"I ask you to imagine yourself with all your appetites and passions, your

bodily necessities and functions, your feelings of modesty, your sense of propriety, your births, your sicknesses, your deaths, your children,—in short, your lives in the whole round of their relationships with the seen and unseen, suddenly shriveled and shrunk into such conditions of space. I might ask you, I do ask you, to consider and honestly confess what would be the result to you."

Irrespective of what facts can be measured, there can be no doubt that the evil of room overcrowding, due as we have seen largely to the practice of taking outsiders into the family life, is one that is fraught with serious consequences to the welfare of the community as well as to the individual. Where this evil is entrenched, it must be fought resolutely; where it has just begun to show itself, it should be nipped in the bud. No sentimental plea of the rights of the individual should be tolerated. Let us not be led astray by the argument that the workingman's home is his castle, that its privacy cannot be invaded by officials for inspectorial purposes any more than the rich man's.

We admitted long ago the right of the community to inspect and control both rich and poor in cases of contagious disease, and it is a slavish devotion to dogma that does not recognize the right of governmental interference where the peril is both moral and physical. Nor should we be influenced either by the plea of poverty and necessity that the workingman is forced to these conditions and that, therefore, the evil must be tolerated.

Just as surely as it is tolerated, we must face the breaking down of American standards of living, of morality, of civic and social responsibility, of even liberty itself.

Like many other social problems, it is mush easier to state the conditions as observed than to formulate effective methods for remedying them.

Out of our seventy years' experience in America, it might be supposed that we should find some experience in coping with this evil which would aid us. The only two cities that I know of where any serious effort has been made to meet the situation, are New York and Boston, and while neither of these communities can be considered in the slightest degree as having solved this problem, yet, there is that in their experience which is of value to us; we may learn more from mistakes sometimes than from successes.

About fifteen years ago, New York City did make a more or less serious effort to cope with the problem. In those days the enforcement of the tenement laws was vested in the Health Department which had its offices in the heart of the lower Italian Colony, down in Mulberry Street, a few blocks from the notorious Mulberry Bend, made famous by that valiant apostle of tenement house reform, Jacob A. Riis.

The method employed at that time was as follows: Policemen in squads of two were sent out to make night inspections in those tenements in which

the Board of Health expected that room overcrowding would prevail. This was chiefly in the Italian and Russian Polish colonies. Each night the officers started on their work about eleven o'clock and worked until three in the morning. Entering a tenement house they would quietly ascend the stairs and knock at the door of an individual apartment. After a long delay, some sleepy voice would call out in Italian "What was wanted?" to which the answer would be "To open the door that they were the police." After a long delay the door would be opened and admittance gained; all that generally would be discovered would be a very sleepy Italian family in various stages of undress, holding a lighted candle or lamp, and grumbling at being disturbed in their slumbers. The officers would then carefully search through the rooms, and as a rule would find no one there but the members of the family. They would then descend to another apartment, and the same process would be repeated throughout the house.

To the observer who happened to be passing through the street at that time, an interesting spectacle was presented. His curiosity, I am sure, must have been very much piqued; he must have wondered what that stream of men was going up and down on the outside fire-escapes; for the "simple Italian peasant" in his childlike innocence had seen to it that all lodgers and boarders went out by the windows and down the fire-escapes on the front of the building, while the officers of the law were making their inspections, not to return until they had departed, when the colony of lodgers returned to their slumbers. So fine an art did this become in later years that the lodgers learned "to do the trick" without getting off the fire-escapes at all.

It is obvious that this method of enforcement was not a success. While it made the Board of Health appear diligent in good works, and while it did keep the persons who were guilty of the practice of taking in lodgers on the alert and made them realize that this practice was against the law, so far as the lodger evil itself was concerned, it had little practical effect.

For other reasons, this method was unsatisfactory. In the few cases where evidence of overcrowding was obtained, the case would be taken into a police court the following morning, and the tenant, generally a foreigner, haled before the judge. Why they always should have been "widows" I have never been able to find out, but widows they were; with her would come all of her own children, and—some borrowed from the neighbors for the occasion. She would shed copious tears, and between sobs would explain to the judge that all of the men found in her rooms were "cousins" or friends of the family who were just there for a night or two while they were looking for work. Under these circumstances, it is not surprising that the ordinary police magistrate was not inclined to send the tenant to jail even for a few days for an offense of this kind. And what usually happened in the old days when New York's police bench was run

as part of the political machine of the city, was that the case ended in the magistrate reading the policeman a lecture for harassing a poor woman who had so much difficulty in earning her living.

With the coming into existence of the Tenement House Department ten years ago, and the transfer of the enforcement of the law to that department, the practice of night inspection was abandoned, not because the evil of room overcrowding had ceased, but because it had been shown conclusively that the methods used had not proved successful.

The only other city where any serious effort has been made to cope with room overcrowding is Boston. Under the laws in force in that city the only power which the Health officers have when they discover evils of this kind is to order the premises vacated; that is, have the lodgers removed. They are utterly unable to bring about the punishment of the persons responsible for the evil. In response to a recent inquiry, the Health Department of that city says: "Where we have been able to prosecute under the public lodging house law, these people have been turned out of business, but where vacation is the only remedy, we have found that it is absolutely ineffective, as we have been driving the same people from place to place for the last twenty years, and there is no doubt that they will continue in the business as long as there is a profit in it. In the cases which were prosecuted, where the fine of fifty dollars was imposed, every one of the offenders convicted quit the business."

It is thus seen from the experience of these two cities, which may be taken as fairly illustrative of others, that not only have the methods heretofore employed been ineffective, but that there are inherent difficulties in the situation to be overcome. Not only are the existing laws inadequate, but the attitude of our minor courts and of the public generally must be changed before we can expect satisfactory results.

How inadequate our laws are is soon seen. The only requirement to be found in most states is the one that there shall not be less than a certain amount of cubic air space for each occupant of the room. Speaking generally, this has been, with one or two slight exceptions, the only form of legislation that has been attempted. So accepted has this idea of cubic air space become in the popular mind as the measure of good or bad conditions, that it is only recently that we have been able to impress upon health officials and housing workers the fact that many other considerations are involved than this one of the amount of air that is available in a given space. Far more important than the mere amount of air space is the kind and quality of the air, the frequency of its renewal, the possibility of its movement within the room, the kind of room that is occupied—whether it is well-lighted and whether sanitary conditions are observed. As the writer has had occasion to point out frequently, a very small room opening directly on the street, with a large window, well lighted and ventilated,

and with cross ventilation, even though small in size, is far better as the sleeping quarters of two adults than a much larger room affording twice as much cubic air space per occupant, badly ventilated and securing its ventilation from a small enclosed air shaft.

Has not the time at last come when the housing workers and health officials of the country should embark upon a campaign of education of the public, on the fallacy of cubic air space as a measure of proper conditions? We need to wage an active campaign against high temperature and air that is not moved, rather than on lack of cubic air space.

The only other provision to be found in our housing laws dealing with this subject, is the requirement, found in the laws of a few cities, that no part of a tenement house shall be used as a "lodging house" which is generally defined as a place in which persons are harbored or received or lodged for hire for a single night or for a week or less. Were this provision to be invoked in an attempt to prohibit the taking in of lodgers, I have no doubt that it would prove quite valid, but I know of no city that has up to the present time made use of it.

It may well be asked by the thoughtful observer, "If America has so singularly failed to cope with this evil in her seventy years' effort to regulate housing conditions, what has been the experience of Europe?" Can we not find there some way out of our difficulty? Many social workers I know, feel that in the experience of Great Britain at least, the solution is to be found. In the Scotch cities of Glasgow and Edinburgh, there exists what is known as the "ticketed house" system, a scheme by which the sanitary officers measure a suite of rooms, calculate how many people may be permitted to live in it upon the basis of cubic air space, and with due regard to its sanitary conditions and the adequacy of its light and ventilation, and then affix to the door of the apartment a ticket or placard stating that the rooms may not be occupied by not more than so many people. Then, subsequently, night inspections are made, and if it be found that the rooms are occupied by a larger number of people than called for on the ticket, prosecution of the tenant is had.

We have been often urged to adopt this system in America. It happens that the city of Washington has had a law of this kind for some twenty years past. Upon inquiry, I learn that it has never been used in the dwelling houses or tenements of that city, but only in connection with the common lodging house. We therefore have little to guide us in the practical experience of any American city as to the value of this method as applied to American conditions, but in the fact that the responsibility for complying with its provisions rests on the tenant, it offers little hope as of value for American conditions.

My own belief is that our failure to remedy conditions heretofore has been due largely to the fact that we have not recognized with sufficient

clearness that the lodger evil is the root of our room overcrowding problem; that our minds have been confused because of the cubic air space requirement; that we have failed to take the public with us and to keep them informed sufficiently as to the evils resulting from the conditions that we have sought to remedy, and that, especially, we have used or attempted to use a wrong method of administrative machinery. As long as we look to the irresponsible tenant as the person to hold responsible for these evils, just so long are we sure to get unsatisfactory results. What the situation requires is that we should all clearly recognize that the maintenance of a tenement house is the running of a business, and that the man who runs that business assumes definite responsibilities toward the community which he cannot escape.

My solution for this evil, therefore, is that we hold the landlord primarily responsible for the taking in of lodgers into the apartments of families who occupy his building. While it may seem a novel proposition to hold the landlord responsible for something which many people feel he cannot be responsible for, yet, it is in reality no new thing. For over ten years now in New York, we have held the landlord responsible for the moral character of his tenants, and we have done this most successfully. In the New York Tenement House Law a landlord is responsible, and with a very serious degree of responsibility, for the presence of prostitutes in his tenement house. If such women are found and are not promptly removed from the house upon notice from the public officials, the house itself becomes liable to a penalty of one thousand dollars ($1,000)—a penalty which cannot be escaped. This provision has proved so admirably adapted to its purpose that in all this time, although there have been many cases of this kind brought, there has been no instance where it was necessary to seek the collection of the penalty or the bringing of court proceedings in order to make the landlord comply with the law. A mere notice has been all that was necessary to secure action. He has been quick to dispossess tenants of this character.

What I propose now is that we should apply this same principle to the problem under consideration; that we should prohibit the taking of lodgers and boarders into an apartment without the consent in writing of our Health Officials and that we should then hold the owner of the house responsible through heavy penalty for any violation of this provision. Let us not be deceived by any false claims on the part of the landlord that he cannot know what is going on inside the apartments of the individual families in his building. Such a claim is not true. It is his business to know whether his tenants are taking in sub-tenants; it is his business to so look after his property that he will know what is going on in his house; it is his business if the house is one of any considerable size to have on the premises a resident janitor or caretaker, to keep an eye on all of the condi-

tions in that building. The janitor always knows when families are taking in lodgers or boarders. It would be impossible to escape such knowledge. Where the house is merely a small one, and no janitor is provided, the owner himself must act as janitor, but in such houses, as a rule, the lodger evil is not often encountered.

Some may ask would it not be simpler to prohibit outright the taking of lodgers in a tenement house. Undoubtedly it would be easier, but, unfortunately, it would not be fair or reasonable, nor would such a requirement, in my judgment, stand the test in the courts. To withstand such a test successfully, it would have to be shown in all cases that the practice of taking in lodgers was injurious to the community; the exercise of the police power by the state would have to be justified.

Moreover, it would work real hardship in many cases. Take the case, for instance, of a high-class apartment house (which must, under our tenement house laws, be considered as a tenement house) where one of the tenants is suddenly left a widow and has on her hands a large apartment at an expensive rental, she must in order to live, take in one or two persons to enable her to meet her obligations. Under such circumstances, the taking in of lodgers, as we all readily admit, is fraught with no evils and is a perfectly proper thing to countenance. It is seen, therefore, that we cannot go to the extent of absolute prohibition. We must, accordingly, leave in the hands of our Health Officials the right to say when lodgers may be taken and when they may not; let us not attempt to establish in our laws arbitrary and fixed standards; but let us leave the decision to be determined by the responsible public official with regard to the particular facts in each case.

The following provision of law I would suggest should be incorporated in all housing laws and also adopted by our Health Departments as part of their sanitary codes:

> "No tenement house, nor any part thereof, shall be used for the letting of lodgings without the consent in writing of the Board of Health, nor shall any person not a member of the family be taken to live within an apartment occupied by any family, without such consent. It shall be the duty of the owner of such tenement house to see that the provisions of this section are at all times complied with, and a failure to so comply on the part of any tenant, after due and proper notice from him, shall be deemed sufficient cause for the summary eviction of such tenant and the cancellation of his lease."

With such a law and with an awakened public sentiment realizing keenly the dangers of room overcrowding, it would be possible in a short time to nip this evil in the bud in practically all of our cities, except of course, always, the City of New York. There the same remedy is required but, owing to the extraordinary conditions which prevail in that city, a long

period of time will be required to bring about a change in the situation, as the evil has grown so rapidly and conditions have been neglected for so long.

With a provision of this kind on our statute books the methods of administration to be employed will be comparatively simple. From the point of view of the enforcing officials what will be required will be in the first place a very complete notification to the owners of all tenement houses of the new requirement and a warning that the responsibility now rests upon *them* and that any deviation from the strict letter of the law in this regard will be rigidly punished in future. The Health Department will also be under the necessity of having initial inspections and measurements made of all rooms in those portions of the city where they expect the evil is most likely to occur, so that they may have on file in their own records, in convenient form, readily accessible the exact number of adults and children that may be permitted with safety to occupy each individual suite of rooms. Following this measurement, written notice should be sent to the owner informing him of the maximum number of persons that may be lodged in the individual apartments of his building, and calling his attention to the fact that no persons except those to whom the apartments are let may be taken to live there without the consent in writing of the Health Department.

Then, from time to time, night inspections would have to be made by the health officers and, where it was found that lodgers were being taken, court proceedings would have to be instituted against the owner. Presumably it would be wise policy, in the first instance, to warn him and to threaten court proceedings in the next case that occurred in his house; then keep a very close watch upon his property.

So much for our Health Officials. How would such a plan work with regard to the landlord? What methods would he have to adopt in order to make this plan a success? If he were a wise landlord he would put a clause into the rent receipt which is given each month to the tenant, calling attention to the fact that no one can be taken to live in the individual rooms of that apartment without his consent and without the written consent of the Health Department; he could also state in his lease that the apartment is rented to this particular family, consisting of so many persons; a method that is now generally employed in the case of high-class apartment houses, in which class of realty the standard lease contains a clause that the apartment shall not be sublet without the landlord's consent. If he were a wise landlord he would also give a similar printed notice to the tenants upon their first moving into the house; thus calling their attention to the limits of the occupancy before they actually moved in. He would also cause his janitor to be vigilant and see that no lodgers were taken into the house, nor would he wait for the health officials to

discover the presence of this abuse, he would discover it himself and deal with it accordingly. And finally if he should receive a notice of violation from the Health Department, a first warning, he would without the least hesitation dispossess the tenant.

That such a plan is sure of successful administration, there can be little doubt. That such a plan would, if fairly administered, do away with room overcrowding in most of our cities, I similarly have no doubt. What is required now is that it should be adopted as a basis of practical operation for the future, assuming it commends itself to the judgment of our health officials and our housing workers.

Two points of vital importance must not be lost sight of; one is something that we are apt to forget, namely, that the tenement dweller knows that it is wrong to take in lodgers. I am sure there is not one of us, whether social worker, housing reformer or health official, who has not uniformly been made aware of this in his dealings with the tenants. The tenant is quite conscious that the taking in of lodgers is against the law, even in many cases where it is not, believing it to be so—and is always careful to conceal the facts so far as he can. This makes the situation helpful; for, in carrying our plans into effect, we shall not have to impose upon the working people requirements which may seem to them new interference with their liberty.

The other vital point is that we cannot succeed in this effort unless we see to it that the community is thoroughly aroused to the evils of room overcrowding and is kept aroused; not only must we educate the general public, but we must give especial attention to the education of our minor courts. The judges before whom cases of this kind must go must be made to see at first hand the serious consequences of this evil. Excursions must be arranged by which they can accompany the sanitary officers on their midnight inspections and can see for themselves the conditions which prevail. Through conference with social workers and prominent citizens, they must be made to realize the strong public sentiment that there is in the community for the doing away with these evils.

If we are to do away with the lodger evil, our remedies must be twofold, repressive and also constructive. We must not only make impossible by law the taking of lodgers into the family life, but we must recognize that there is need of some place in which the large number of single men that come to our shores—single so far as we are concerned, that is, men without families in this country, can be cheaply lodged. We must recognize too, the necessity of their being lodged near their fellow-countrymen, so that they may be near people that speak their language and who have common interests.

This means, therefore, that in our large cities, where there is a considerable alien population, we must carefully find out the facts as to the need of

housing accommodations for single laborers of this kind, and see to it that lodging houses of the very best type are provided for their accommodations, placing one of these in each alien center, and not attempting to house the various races in the same house. They will not mix, so do not let us attempt it, but let us rather build a lodging house for Italians in the Italian quarter of our cities; similarly a lodging house for Poles in the Polish quarter of the city, and so on.

Here there is great opportunity for our philanthropists. It is pioneer work; the ground has to be broken from the very beginning. We have yet to learn what is the best type of lodging house to build, the whole question is still to be studied in all its aspects.

I have every confidence that with the adoption of these plans room overcrowding will in the course of a few years cease to be a factor in America's housing problem. But this result cannot be accomplished unless we set ourselves resolutely to work. What is needed is not discussion but action. The way to begin is to begin, and the time to begin is now.

A STUDY OF THE DEATHS FROM TUBERCULOSIS IN THE FIFTH WARD (PHILADELPHIA) DURING A PERIOD OF FORTY-SEVEN YEARS.

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In the crusade against tuberculosis it is of the utmost importance, especially in the formulating of health regulations for a large community, that our principal attack should be directed toward that point where most of the infections occur. In determining this point it is essential that we have accurate information in regard to certain phases of what might be termed the "natural history" of the disease.

Do most of the infections occur in the public streets, conveyances, or meeting places; in the work-shops or factories; or in the home itself? This study of the deaths occurring in one ward of a large city over a considerable period of time was made with the idea of throwing some light on this question. Its main object being to determine to what extent house infection might be considered a factor in the spread of the disease.

DESCRIPTION OF THE FIFTH WARD.

The Fifth Ward was selected as it was the ward which Doctor Flick selected as the subject of his valuable contribution to the study of this disease in 1888 (The Contagiousness of Phthisis—Trans. Med. Soc. State Pa.). Much of the data which he collected at that time he very kindly placed at my disposal.

It is a ward the population of which is made up largely of Russian Jews and Negroes with a few Italians, Slavs, and Irish. In the earlier years under consideration the population consisted chiefly of Americans and Irish, later the Negroes predominated, but of late years the Russian Jews are in the majority.

The inhabitants belong to that class of people which is not accustomed to a long residence in any one place, but frequently change their dwelling, usually moving to another house in the same neighborhood. This was very clearly shown when we attempted to study the relation between the present series of cases and the patients attending the dispensary or hospital of the Henry Phipps Institute who had at one time lived in the Fifth Ward. It was found that the patients moved so frequently that it

was impossible to determine the exact time in which they had occupied a certain dwelling and the study was on that account discontinued.

There are very few large tenement houses in the district, although it is not uncommon to find two or three families occupying the same house, usually one family to a floor. A large portion of the ward is now taken up by offices, storage-warehouses, etc.

OBJECTIONS.

A study based upon the death returns is open to criticism on many grounds as there is such a large margin of error. This is especially true of the death returns in Philadelphia prior to 1890. The following are some of the sources of error:

First: Deaths due to tuberculosis may be returned as some other disease, through error in diagnosis or through the physician desiring to give the family the benefit of the doubt, where such exists, for the sake of the insurance or on account of the popular prejudice against this disease, especially among the Irish.

Second: In former years the undertaking establishment or hospital was given as the place of death and the former residence was not stated. In either case we were not able to consider these deaths (404) in the present study as we had no means of determining the former residence of the patient.

Third: The address was at times so indefinite that the exact location could not be considered in the present study.

Fourth: The terminology was formerly very indefinite at times, terms being used which are now obsolete, and, therefore, a certain number of deaths from tuberculosis may have been overlooked in collecting our data. We have included in the present series all deaths due to phthisis pulmonalis, consumption, pneumonic phthisis, miliary and general tuberculosis, tuberculous meningitis, enteritis, nephritis and peritonitis, scrofula, Pott's disease, hemorrhage of the lungs and catarrh of the lungs.

Fifth: We are unable to show in any of our cases how long the patient had been ill, how long he had occupied the dwelling, or which portion of it he occupied. We could not determine whether the succeeding case was living in the house at the time the preceding case died, or how soon after the death of the first it was occupied by the second, or whether the second occupied the same quarters as the first. Neither can we show how cleanly the first case was or whether he carried out any measures of prevention.

Sixth: Another source of error is the impossibility of excluding other possible sources of infection in the individual case.

These points of weakness in the present study should all be borne in

mind when considering the value of the results and the conclusions based on such results.

HOUSE INFECTION.

We possess very definite information in regard to the *possibility* of house infection obtained by very careful investigation which can be applied to the present study, rendering our conclusions more than merely suggestive especially as the number of cases considered is large.

It has been clearly demonstrated by Cornet (Zeit. f. Hyg. 1888, Bd. V) and other observers that *virulent* tubercle bacilli may be found present in the room occupied by a careless consumptive as long as six weeks after the death of the patient. Coates (Brit. Tuberc. Congress Vol. 11, p. 88) has shown that the mode of living has a definite effect upon the frequency with which the bacilli are found. In his investigation virulent bacilli were found in 66.6 per cent of the dirty houses which had been occupied by a consumptive and in only 50 per cent. of clean houses. From a personal experience with the houses under consideration the writer is of the belief that a conservative estimate would place 75 per cent. of the houses in the first group.

It is impossible to refer to the numerous instances cited by various writers in which tuberculosis has developed in persons previously healthy after occupying dwellings recently occupied by consumptives. We are convinced that the possibility of infection with tuberculosis from an infected house has been clearly established, our effort in the present study being merely to attempt to show to what extent house infection may be considered a factor in the spread of the disease.

TOTAL DEATH RATE FROM TUBERCULOSIS.

To show the relative position of the ward in regard to the rest of the city, as far as tuberculosis is concerned, we have prepared a chart giving the annual death rate per thousand of the living population (Chart 1) for the entire forty-seven years. As the ward constitutes only about one eightieth of the entire population of the city (16,868 in a population of 1,293,000 in 1900) the ward rate naturally does not follow the city rate at all closely. It will be seen, however, that although the ward rate occasionally falls slightly below the rate for the entire city, it more frequently rises above it and at times to a marked degree. This will probably give one a more accurate idea of the type or character of the ward than any method that could be employed. There is a very striking and sustained rise above the city rate from 1880 to 1889. It is very difficult to explain this rise except on the ground that it was possibly about the period during which the Negro population in this ward was at its height. For the rise from 1904 to 1909 we have not adequate explanation unless the establish-

ment of the Henry Phipps Institute led to a more frequent diagnosis of tuberculosis.

RELATION BETWEEN DEATHS, POPULATION AND HOUSES.

From the year 1863 to 1909 (inclusive) there occurred in the Fifth Ward 2,849 deaths from tuberculosis. Of this number 404 were returned from undertaking establishments and hospitals, and 196 gave addresses so indefinite or incorrect that we are forced to discard them. This leaves us with 2,248 deaths in which the residence was definitely determined.

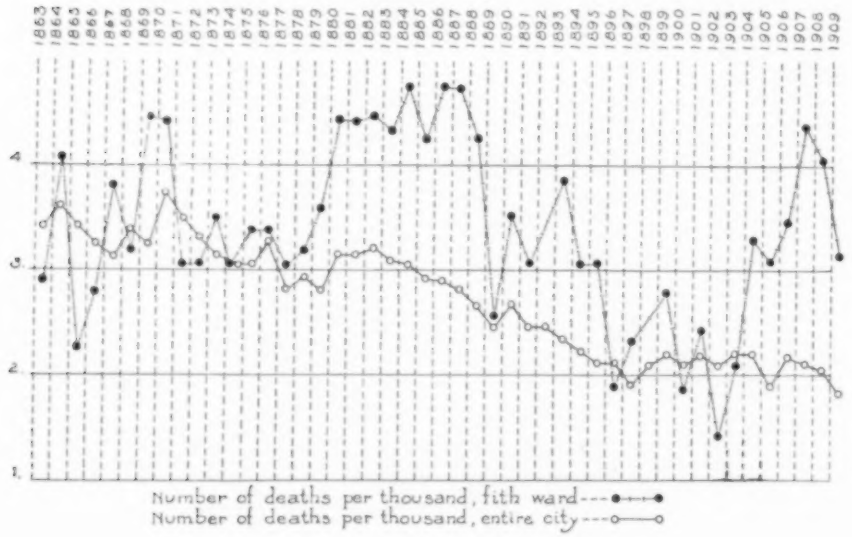
A study of these gives the following:

A.	Total number of streets in the Fifth Ward	67
	Number of streets in which deaths occurred	57
	Percentage of streets in which deaths occurred	85%
B.	Total number of deaths for 47 years	2,248
	Total number of houses in which deaths occurred	1,312
	Average number of deaths per house infected	1.7
C.	Total number of houses in Fifth Ward (1909)	1,676
	Total number of houses in which deaths occurred	1,312
	Percentage of houses in which deaths occurred	78%
D.	Total number of houses	1,676
	Total number of deaths	2,248
	Average death per house	1.3
E.	Average number of deaths per year	47.8
	Average population	17,657
	Average number of deaths per 1,000 population	2.7
F.	Number of streets in which three or more deaths occurred	20
	Number of houses in which three or more deaths occurred	62
	Total number of deaths occurring in these houses	252
	Average number of deaths per house	4.06
G.	Total number of houses in which deaths occurred	1,312
	Total number of houses with three or more deaths	62
	Percentage of houses in which deaths occured having three or more	4.7%
H.	Total number of deaths in ward	2,248
	Number of deaths occurring in 4.7 per cent. of houses	252
	Percentage of deaths occurring in 4.7 per cent. of houses	11.2%
J.	Total number of inhabited houses	1,676
	Number of houses in which 11.2 per cent of deaths occurred	62
	Percentage of total houses	3.6%

A study of the above shows that in a period of forty-seven years a very high percentage of streets (85 per cent.) and houses (78 per cent.) (*A. and C.*)

have had one or more deaths; that the deaths averaged 1.3 (*D.*) to every dwelling in the ward. When we ne to consider the houses in which three or more deaths occurred we · struck with the fact that 11.2 per cent. (*H.*) of all deaths in forty seven years occurred in a very small proportion, 3.6 per cent (*J.*) of the houses in the ward. Showing that the deaths from tuberculosis tend to be confined to only a few dwellings, these dwellings in the present series averaging 4.96 deaths per house. This was much more strikingly shown by Doctors Biggs and Guerard (Report of Board of Health of New York City, 1897) in their study of the conditions in New York City when they found 55.8 per cent. of the cases of tuberculosis in

CHART 1.



10.5 per cent. of the houses. They considered reported cases as well as deaths, and were dealing with a much more congested population (27.6 individuals per house) than in the ward we are considering at present (10.27 individuals per house). Their study covered a period of only three years.

We found that 24 per cent. of all deaths occurred in houses in which a previous death from tuberculosis has occurred. As our study covered a period of forty-seven years it makes it possible for the previous deaths to have occurred forty-six years before the second, under which circumstances it would be beyond the range of possibility for the second death to have had any relation to the first.

SELECTION OF TIME PERIOD.

In trying to decide what period of years to allow for the possibility of infection from the first case to the second, the following factors were considered:

First: How long before death could the patient be considered infectious to other people living in the same house.

Second: How long the average case lived after infection.

Third: How long after the death of the first case could the house be considered infectious to a second party moving into the dwelling.

After a very careful consideration of all the factors involved, in the absence of any definite data in regard to any individual case, we considered a period of *four years* (for example, the first death in 1900, second death in 1903) to be a reasonable interval considering that we are dealing with *deaths*. We have, therefore, studied the present series of deaths with the object of determining how many deaths occurred within a period of four years subsequent to another death. While the period of years selected is purely empirical it is at the same time a very conservative estimate for the period of *death to death* (not death to infection or death to signs of disease).

STUDY OF CASES WITHIN FOUR YEARS PERIOD.

Of the 2,248 deaths 353, or 15.7 per cent. of the total number, occurred within a period of four years following a previous death in the same house. This does not include the primary case, but only the subsequent cases. In other words, 15.7 per cent. of all the deaths in forty-seven years were possibly due to house infection. Of the 353 cases, 62 were apparently related. Omitting these we still have a percentage of 12.9. Of the 540 cases occurring in houses in which a previous death had occurred 65.3 per cent. of them came within the four-year period.

When one considers the relative frequency with which one obtains a history of a previous death from tuberculosis in the house in which the patient lives, outside of a member of the immediate family, the above percentages are astonishingly high. The only means we possessed for determining relationship was the similarity of the names. We consider our estimation as probably correct as the people with the same name and not related would probably balance those related but with different names.

A study of these 353 cases shows the following:

A.	Number of streets in which case died within 4 years of another	39
	Number of houses in which case died within 4 years of another	242
	Number of cases in which case died within 4 years of another	353
	Average case per house	1.04

B.	Total number of houses in which deaths occurred	1,312
	Total number of houses having cases dying within 4 years of another	242
	Percentage of houses in which deaths occurred having cases dying within 4 years of another	18.4
C.	Total number of deaths in ward	2,248
	Deaths occurring in 18.4 per cent. of houses	353
	Percentage of deaths in 18.4 per cent. of houses	15.7%
D.	Total number of inhabited houses	1,676
	Number of houses in which 15.7 per cent. of deaths occurred	242
	Percentage of houses in which 15.7 per cent. of deaths occurred	14.4%

We see from the above that during forty-seven years 14.4 per cent. (*D.*) of all the houses in the ward or 18.4 per cent. (*B.*) of all the houses in which a death from tuberculosis occurred contained 15.7 per cent. (*C.*) of all the deaths which could be possibly due to house infection or infection in the house.

We do not believe that the figure 15.7 represents by any means the percentage of cases infected in the house, but we do consider that it does show that infection from the house is much more frequent than is usually considered and that this phase of the tuberculosis problem has not received sufficient attention.

ELAPSED TIME AND RELATIONSHIP.

When we come to consider the relation in point of time of the second death to the first we find the following:

Same year as first, 82 or 23 per cent. of which 23 or 28.1 per cent. were related.
Following year, 108 or 30.6 per cent. of which 19 or 17.6 per cent. were related.
Second year, 93 or 26.4 per cent. of which 16 or 17.2 per cent. were related.
Third year, 70 or 20.0 per cent. of which 5 or 7.1 per cent. were related.

This brings out in a very striking manner the fact that contagion from a member of the same family probably preceded the death of that member by several years. In this way only can we account for the higher percentage of deaths of relations in the same year. This will be considered further when we take up the question of infection in children.

DEATHS FROM TUBERCULOSIS IN CHILDHOOD.

Bovine Infection.

When we study the deaths from tuberculosis in children under the age of seven years another point of interest is brought out. As this is of

extreme importance in its relation to the question of bovine infection we have considered it worthy of a separate study. We have, therefore, attempted to show how many fatal cases of tuberculosis in childhood had occurred in a house in which a case had previously died from tuberculosis within four years. Of the 182 deaths in children, 52 or 28.6 per cent. occurred in a house in which a case had died within a period of four years from tuberculosis. In twelve instances they appeared to be related to the previous case. The fact that we find such a large proportion (28.6 per cent.) of deaths from tuberculosis in children occurring in houses in which a death from the same disease has occurred within the four years preceding, would certainly tend to support the view that the majority of infections in childhood are of the human rather than the bovine type. That this percentage is higher in children (28.6 per cent.) than in adults (14.5 per cent.) might be accounted for by the shorter duration of the disease in children thus bringing more of them within the four years period. In two instances death occurred in a child in the same house in which a child had previously died from the same disease within four years. Of the 182 cases occurring in children the following were given as the cause of death

Phthisis pulmonalis	110	(60.4 %)
Tuberculous meningitis	47	(25.8 %)
Tabes mesenterica	6	(3.34%)
Pulmonary hemorrhage	3	(1.62%)
Tuberculous peritonitis	3	(1.62%)
Miliary tuberculosis, hemorrhage, consumption of bowels and catarrh of lungs	2	(1.62%) each
Scrofula, tuberculous pneumonia, tuberculous hip-disease, infantile consumption and generalized tuberculosis	1	(.54%) each

As to how soon death occurred after the previous case of tuberculosis in the same dwelling the following refers to thirty-five children:

Same Year.	*Following Year.*	*2d Year.*	*3d Year.*
13 (37%)	7 (20%)	7 (20%)	8 (23%)

For (318) adults we have the following:

Same Year.	*Following Year.*	*2d Year.*	*3d Year.*
69 (21.7%)	101 (31.8%)	88 (27%)	62 (19.5%)

It will be noticed that in the children the highest percentage of deaths occurred in the same year, while in the adults in the following year. This may be explained by the longer duration of disease in adults as compared to the children in which it runs a relatively rapid course.

ELAPSED TIME AND RELATIONSHIP.

Deaths during same year in the children, 46 per cent. were related.
Deaths during same year in the adults, 24.6 per cent. were related.
Deaths during following year in the children, 14.3 per cent. were related.
Deaths during following year in the adults, 17.8 per cent. were related.
Deaths during second year in the children, 14.3 per cent. were related.
Deaths during second year in the adults, 17.4 per cent. were related.
Deaths during third year in the children, 0 per cent. were related.
Deaths during third year in the adults, 8 per cent. were related.

This shows in a very striking manner the condition one would expect to find, namely: Firstly, in children the close family relationship and the more rapid course of the disease gives a higher percentage of deaths in the same year. Secondly, the family relationship ceases to be an important factor after the end of the second year. Thirdly, on account of the longer duration in adults the following and second years show a slightly higher percentage not only in the totals but also in those related.

Taking the total cases we find that of the thirty-five children eight (22.8 per cent.) were related, while in the 318 adults fifty-five (17 per cent.) were related. The percentage is slightly higher in the children on account of the much closer contact with the home than is found in the adult. The difference, however, is not so striking as one would expect to find.

WIDTH OF THE STREET.

It has been stated that the width of the street bears a definite relation to the number of deaths from tuberculosis. H. S. Anders (Univ. of Penna. Med. Mag., 1891) found in another ward in this city that the greatest number of deaths from consumption occurred in the small streets or blind alleys, and that relatively few occurred in the broader streets. We feel that the only basis upon which such a statement could be made would be upon the study of the deaths in relation to the number of people living in such a street. As we have no reliable information upon this point in regard to the Fifth Ward, we have taken the deaths occurring on each street and reduced them to the same factor (seven squares long, both sides of the street), as it would be unjust to compare the number of deaths in a street seven squares long to the deaths in one only one-half square long. We have upon this basis arranged our streets according to widths in Chart 11. It must be remembered, however, that the number of deaths given under the heading "Estimated" is not the actual number of deaths but the actual number reduced to a common factor.

In studying the above one notes that the average number of actual deaths per street increases gradually from 8.3 deaths per street in those under 10 feet in width to 93.0 deaths per street in those over 40 feet in width. It will be seen that the streets under 10 feet in width only aver-

Chart 11.

Width of Street.

	Under 10	10–20	20–40	Over 40
Number of streets	10	18	10	17
Average length of street	.5	1	1.9	6.5
Total number of actual deaths	83	291	283	1581
Average number of *actual* deaths per street	8.3	16.1	28.3	93
Minimum number of *actual* deaths per street	1	1	1	1
Maximum number of *actual* deaths per street	40	70	93	294
Total *estimated* number of deaths	844	1705	853	1783
Average *estimated* number of deaths	84.4	94.7	85.3	104.8
Minimum *estimated* number of deaths	21	7	14	2
Maximum *estimated* number of deaths	196	490	217	294

aged .5 of a square in length while those over 40 feet in width averaged 6.5 blocks in length. It is obviously unfair therefore to compare the number of deaths to one another. If we reduce them to a common factor we find the greatest average number of deaths per street in those over 40 feet (104.8), then those 10–20 feet (94.7), then the 20–40 (85.3) and the smallest number in the streets under 10 feet in width (84.4). As this does not take into consideration the number of people living in the various streets we feel the findings have absolutely no significance.

CONCLUSIONS.

Fully realizing that a study like the present based upon data of so indefinite a nature might readily lead to erroneous views if too closely adhered to, we nevertheless feel justified in drawing the following conclusions:

First: With the information at our command we could determine no relation between the width of the street and the number of deaths from tuberculosis.

Second: That a large percentage of the deaths from tuberculosis occur in a relatively small percentage of the houses.

Third: That in tuberculosis house infection must be considered as one of the most fruitful sources of infection, and should, therefore, be made the object point of any attack upon the disease.

Fourth: As in more than one quarter of the deaths from tuberculosis in children the possibility of contagion from house infection can be clearly demonstrated we feel that efforts toward prevention should be mainly directed against the human source of infection rather than the bovine.

732 Pine Street, Philadelphia, Pa.

American Journal of Public Health

Official Organ of the American Public Health Association
Published Monthly by the American Public Health Association.

VOLUME III.—Old Series Vol. IX. JANUARY, 1913. Number 1

$2.00 a year. 20 cents a copy.

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All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear and are not to be regarded as expressing the views of the American Public Health Association, unless such statements or opinions have been adopted by vote of the Association.

HOUSING AND HEALTH.

Thoughtful observers of the health work of this country have for some time past realized that, if such work is to take its rightful place in public estimation, it must have a well-organized and informed public sentiment behind it. That it has not had this support heretofore has been only too obvious; why it has been without it has not been so apparent. The chief reason has been that the health officials have not sought it, but have waited for private citizens to take the lead. The result has been what one would naturally expect—our Health Departments have been with few exceptions notoriously under-manned and under-financed.

While each year the work of the Police and Fire Departments in all our cities has secured increased financial support, our health Departments have in most cases stood still. Most cities in America today spend ten times more money to protect property than they do to protect health.

That the prevention of disease is the most important subject that can occupy public attention has as yet been realized by but few public officials in most of our cities. Increased appropriations are made grudgingly, and everywhere throughout the country earnest and broad-minded health officers have become discouraged and are giving up the effort as hopeless. The fault is largely their own. They have failed to take the public into their confidence. They have failed to draw upon an almost inexhaustible reservoir of public support.

In the light of these considerations, the Second National Housing Conference, held in Philadelphia last month, has especial significance for the health officers of the country. It points the way to broad fields of usefulness. In every part of the United States there has been an awakening to the dangers of the slum. Stimulated by the anti-tuberculosis movement and by the work of the National Housing Association, groups of people, not only in large cities, but in town, suburb and village, are alive to the dangers of bad living conditions and are demanding the enactment of better housing laws, their strict enforcement and new and advanced standards of sanitation.

Here lies the opportunity of the health official. By taking the lead in this movement, by calling to his aid those citizens who either are interested or naturally would be interested in the improvement of the living conditions of the less fortunate members of the community, he will build up a strong public sentiment for the preservation of health and the prevention of disease.

HYGIENE AND DECENCY: OR SENTIMENT IN SANITATION.

Travelers may often see in railway carriages in Italy the notice—*Per Igiene e Decenzia non Sputare* (For Hygiene and Decency do not Spit).

There is here a lesson for sanitarians. Dirt is not always deadly or even dangerous, and those who teach that dirt is necessarily disease producing will find difficulty in explaining the often long continued and robust health of workers in sewers or upon streets or about garbage piles or in stables or dusty trades. The fact is that so much of what passes for "dirt" is not really excrement (as the word implies) or likely to produce serious disease, that some other reason than imminent danger to life and health must be found for holding that cleanliness is next to godliness. Such a reason sometimes exists in mere decency and therefore in sentiment or good taste. No matter how harmless it may be to soil the hands with stable manure, such soiling offends our sense of decency and good taste, while even if it should be established that spitting is one of the least important methods for the spread of tuberculosis and other infections, it will still be true that the spitting habit must be denounced in the interests of decency.

The fact is that sentiment,—doubtless fortunately,—still plays a mighty part in the world, and that the public is, and ought to be, glad to pay for decency as well as for safety in food and drink. The moral is obvious. *Per igiene e decenzia non sputare.* Teachers of hygiene and sanitation should not forget to enforce the idea that these sciences stand for cleanness hardly less than for disease prevention. Some cities with dirty streets very likely have lower death-rates than some with clean streets; some families in dirty homes less sickness than some in clean ones; and yet it does not follow that cleanness is superfluous. Fire and death very likely do not occur any less often among the insured than among the uninsured, but when they do occur the insured are the better off, and this is probably the basis of the general opinion of mankind that both fire insurance and life insurance are worth while. It is very likely for some such reason as this that public opinion requires cleanliness—an opinion which like many other opinions has finally become a sentiment; for cleanliness is a kind of insurance,—not always sufficient to prevent disease but still always worth while.

THE 37° BACTERIAL COUNT.

GEORGE C. WHIPPLE.

Read before the Laboratory Section American Public Health Association, Washington, D. C., September, 1912.

In 1905 the Committee on Standard Methods of Water Analyses, in its final report to this Association, included among its recommendations the use of nutrient gelatine as the standard medium for the determination of the number of bacteria in water, with a period of incubation of forty-eight hours at 20° C. This was done after an extended correspondence with the leading workers of this country and a tabulation of current practice, described in the second progress report of the Committee in 1901, which showed a practical unanimity in favor of the recommendation. During the past seven years this standard has been recognized and in most laboratories great care has been taken to adhere closely to the prescribed conditions, expensive incubators for automatically maintaining a temperature of 20° having been frequently introduced.

Since 1905 there has been a feeling on the part of some bacteriologists, especially those whose chief interest is in hygienic matters, that the gelatine count at 20° C. is not in itself sufficient, and should be supplemented by a determination of the number of bacteria that will develop on an agar plate incubated for twenty-four hours at 37° C. Still others consider the latter to be so far superior to the former that they prefer to make it the standard medium to be used in all cases, letting the 20° gelatine count fall to a subsidiary place. The present Committee on Bacteriological Methods of Water Analyses has taken this view and in its report made at the Havana meeting in 1911, recommended that "The standard method for determining the number of bacteria in water shall be nutrient agar. All variations from this medium shall be considered special media. If any medium other than standard agar is used this fact shall be stated in the report." In explanation of this the report states further that "since gelatine does not give the total number of bacteria in the water, the committee has thought it wise to use agar incubated at 37° C. as a standard medium. This admits of counts in one day instead of two and gives results on the kind of bacteria growing at blood temperature and therefore, more nearly related to pathogenic types."

The report of this committee has been recently published together with the report of the Committee on The Chemical Analysis of Water.

This sudden change in the standard method of determining the number of bacteria in water has thrown something like consternation among bacteriologists connected with water filtration plants who find that they must change their methods of investigation, or be open to the charge

that they are not using standard methods of procedure. In order to see how this change of standard was regarded by men in charge of filter plants, the writer recently wrote to about twenty of the leading filter operators. Eighteen replies were received. Of these eleven preferred to use the 20° gelatine count, four favored the 37° agar count, while three did not wish to express an opinion until they had tried both methods side by side for a sufficient time. The unpopularity of the change among this important group of bacteriologists has been found to be such that the writer has ventured to bring this subject up for discussion at the Laboratory Section by enumerating the relative advantages and disadvantages of the two methods in connection with the control of filter plants.

In the first place it should be recognized that water filters have a dual function,—that of furnishing water that is clean and water that is hygienically safe, although considered broadly, the former may be taken to include the latter. Filtered water should be free from pathogenic bacteria, from bacteria associated with fecal matter, and from bacteria associated with decomposing organic matter from other sources. We know that such bacteria as B. typhi are dangerous; we suspect that other bacteria of fecal origin may be dangerous; and we are coming to suspect that some of the bacteria associated with the decomposition of organic matter not of fecal origin may not be without influence on the human system. It is a question as to whether some of the common bacteria that liquefy gelatine, for example, and that are commonly found in surface waters, do not play a part in the diarrhœal disturbances of children. This division corresponds somewhat roughly with the common expressions, infection, fecal contamination and pollution.

Our bacteriological tests should be aimed at these three groups of bacteria, and as far as possible, should be made quantitative. Specific tests for pathogenic bacteria cannot be safely depended upon at the present time, although decided progress in this direction is being made, as for example, in the detection of the germs of cholera and typhoid fever.

The most important test for fecal bacteria is that for B. coli,—a test that has been recently much improved and simplified, and that is capable of being made quantitative as well as qualitative, although the labor involved is ordinarily too great for routine work.

The 37° agar count is commonly regarded as a test which, while it is not limited to fecal bacteria, draws the line more closely around them as it eliminates bacteria not capable of growing at the temperature of the human body. Attempts have been made to make this more definite in a variety of ways by the addition of various inhibitive substances, but no method seems to have received sufficient sanction to warrant its general use, the count of acid-producing colonies on lactose litmus agar at 37°, being perhaps the test more commonly used than any other.

The 20° gelatine count does not by any means show the total number of bacteria present in a sample of water. No test will do this. This method, however, comes as near to it as any practical test that has been suggested. It is a favorable culture medium for such pathogenic bacteria as B. typhi, for bacteria of fecal origin such as B. coli, as well as for numerous saprophytic bacteria.

The usefulness of any method of determining the number of bacteria in water in connection with filtration must be judged by: (1) The value of the results as an index of the quality of the water and the efficiency of the filter. (2) The precision of the test. (3) The convenience of the test.

Convenience of the 37° Test.

Gelatine is easier to prepare than agar and requires less time. It is better adapted to the purposes of field work than agar, in that it is easier melted, and adheres better to the glass plates, but on the other hand it is more liable to melt. The colonies on gelatine are more distinct and while some may be masked by the liquefication of the gelatine, this loss is no greater than that caused by the spreading of colonies over the surface of agar plates. In these respects, therefore, the advantage lies with gelatine.

On the other hand, it is extremely difficult to maintain an incubator at 20° C. If the temperature rises only a few degrees the gelatine is melted and the result lost, whereas if the temperature falls much below 20° growth is retarded. During the winter surface waters may contain species of bacteria that develop much more rapidly at temperatures below than at 20°. Incubators can be maintained at 37° without much trouble and with considerable accuracy. Such an incubator is needed for B. coli tests, and hence, one incubator will serve both purposes if the bacterial count is made at 37° instead of 20°. The 37° count is obtained after twenty-four hours, whereas the gelatine count requires forty-eight hours. This gives the results in half the time and enables a larger volume of work to be done with a smaller supply of plates.

The spreading colonies, so troublesome with agar used in ordinary Petri dishes, are largely done away with by the use of dishes with porcelain tops. These ought to be cheaper than glass. The figures obtained from the 37° counts are smaller than those at 26° and this facilitates tabulation. On the whole, so far as convenience is concerned, the weight of the evidence seems to be in favor of the use of the 37° count rather than the 20° count.

Relative Precision of the Counts at 20° and 37°.

This is a matter about which information is meagre. It deserves study in order to determine whether the natural variations in different lots of culture media are of greater influence with gelatine or with agar.

In this connection it should be noted that the recent committee report recommends the use of 1 per cent. agar for quantitative work instead of 1.5 per cent., as prescribed by the previous report. Some bacteriologists who have tried this 1 per cent. agar have not been able to obtain a usable medium, as it was not stiff enough to prevent the colonies from running together. A few experiments made with agar of different percentages have shown that the spissitude, or stiffness of the medium very greatly affects the results, much higher counts being obtained with 1 per cent. agar than with 1.5 per cent. agar. Jackson has recently shown that commercial agar contains more or less water, and in describing the method of preparing agar for typhoid identifications, he has recommended that the agar be dried for 30 minutes at 105° C. before being weighed. This precaution would appear to be advisable also in connection with the preparation of agar for quantitative work, and it would be well to have it explicitly stated in the standard methods.

The 37° Count as an Index of Contamination.

That the 37° count more nearly represents the sanitary quality of water than the 20° count is probably true in a general way, but it is not necessarily so. Comparisons of the results obtained by both methods in samples of water of known pollution have shown that, generally speaking, in unpolluted waters the ratio of the 37° count to the 20° count is low, seldom being more than 10 per cent. and not infrequently falling to less than 1 per cent. In sewage the ratio is usually above 60 per cent. and may be 100 per cent. or more.

In looking over the published data, it has been surprising to find in how few instances comparative counts at 20° and at 37° have been systematically made. Where these have been made throughout the year, it has been generally found that during the winter the ratio has been very much lower than during the summer. This is shown by the following figures taken from the annual reports of the Water Department at Wilmington, Del., for 1908 and 1909:

At Watertown, N. Y., where the Black River water is filtered by a mechanical filter, comparative counts at both temperatures have been made daily since February, 1910. The difference between the two counts is striking. The 20° counts are very high in the winter and spring, but are low during the summer, whereas the 37° counts are low during the

COMPARISON OF 20° AND 37° COUNTS OF THE RAW WATER AT THE FILTER PLANT AT WILMINGTON, DEL.

1908.			1909.		
Gelatine at 20°.	Bile Agar at 37°.	Per cent.	Gelatine at 20°.	Bile Agar at 37°.	Per cent.
4,630	124	2.7	3,880	94	2.3
6,830	358	5.3	4,800	260	5.4
8,800	350	4.0	4,620	387	8.4
3,170	149	4.7	5,080	347	6.7
2,010	119	5.9	3,340	229	6.8
1,640	241	14.7	2,350	158	6.7
3,150	432	13.7	2,940	57	1.9
3,140	451	14.4	1,430	230	16.1
3,400	644	18.9	2,620	619	22.8
5,180	439	8.5	1,380	129	9.4
6,850	78	1.2	1,650	97	3.9
4,100	203	4.9	4,150	194	4.7

winter and spring and high during the summer, at which season the sewage which enters the stream is less diluted. The ratio of the 37° counts to the 20° counts is less than 1 per cent. during the winter, but rises to 20 per cent. or more during the summer. The tests for B. coli in the raw water are a little higher during the summer than during the winter, thus corresponding with the 37° counts. This seasonal change would have considerable significance if it were confined to contaminated waters, but to some extent it is observed in waters that are not contaminated. Recent tests at Springfield, Mass., on a stream which drains a very sparsely populated area showed ratio of 30 to 50 per cent. It is possible that the phenomenon is a seasonal one, depending upon temperature rather than upon contamination.

In the winter certain species of bacteria, which appear on the gelatine plates as minute points, are often very numerous, samples of water sometimes containing several hundred thousand per cc. These bacteria readily pass through filters, making the effluent counts high. At this time the 37° counts are low, often less than 0.5 per cent. of the 20° counts. Judged from the 37° counts alone, the inference would be that the filtered water was safer during the winter than during the summer, yet practical experience has shown that it is during the cold weather that water-borne diseases are most likely to be transmitted.

Thus it would appear that the evidence as to the sanitary significance of the 37° count in filtered water is somewhat conflicting and needs further study.

The 37° Count as a Guide in the Operation of Filter Plants.

The principal reasons given by the filter operators for preferring the 20° count to the 37° count were, first, that the former had been used for many years and to change now would introduce an unnecessary element of confusion; second, that if the 37° count were used the results from many of the filter effluents would be very low, and often zero, so that this method would not be sensitive enough to show slight differences in the operation of the plant.

These low 37° counts might be considered as showing a satisfactory condition of the effluent if the removal of contamination alone were considered; possibly not if pollution from other sources were taken into account. That is, the 37° count might show a perfect effluent, while the 20° count might show that the filtered water was not perfectly filtered.

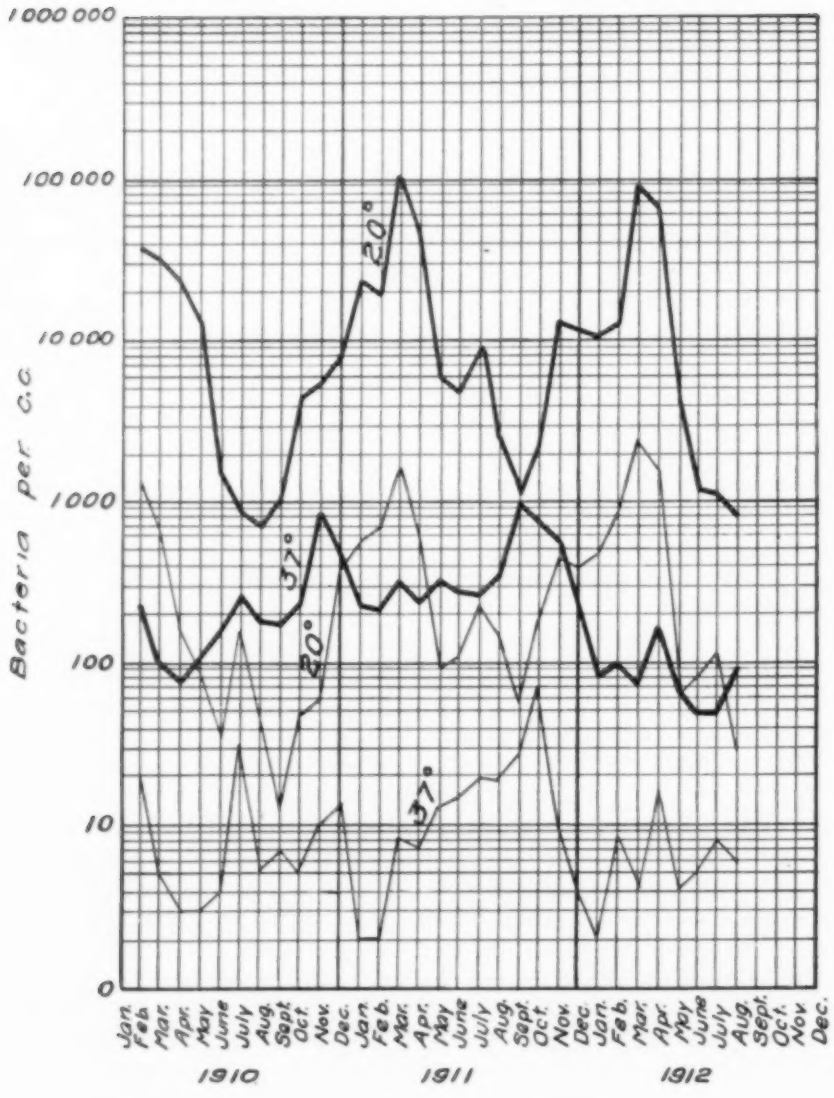
It is argued that in sand filters many of the 20° bacteria represent growths in the underdrains, but there is no evidence that such growths are altogether harmless.

So far as measurement of filter efficiency by percentage removal of bacteria is concerned, the two methods would give the same results if the ratios between the counts at different temperatures were the same for both the raw and the filtered water. As a matter of fact the ratio is not quite the same, so that, as a rule, the percentage removal of bacteria calculated from the 20° count is greater than that calculated from the 37° count. Sometimes, however, the reverse is the case. The percentage removal calculated from the 37° count usually falls during the summer, which would indicate that the filter efficiency was lower during the warm weather than during cold weather, while theory indicates that the reverse should be true. The percentage efficiency calculated from the 20° count is more nearly constant through the year, and agrees better with theory.

Another objection raised to the 37° count is that at present we do not know how to interpret the results. It is generally considered that filter effluents should contain less than 100 bacteria per cc. as shown by gelatine count. Who knows what would be the equivalent of this with the 37° count?

Conclusion.

All things considered it would appear to be unwise to change abruptly at this time from the 20° to the 37° count, as a guide in the operation of water filtration plants. Before this is done extended comparisons of the two methods should be made at many places and the data carefully ana-



Watertown, N. Y.
Comparison of Bacterial Counts at 20° and 37°

Raw water shown in heavy black lines.
Filter effluent before disinfecting shown in light lines

lyzed to determine whether or not the change is advisable. Another objection to changing at this time is the possibility of using synthetic media in the future. All media composed of variable ingredients are unsatisfactory and bacteriologists are looking forward to the employment of media more definite in composition. Should such a change occur in the near future it would be better to adhere to present methods until that comes about.

It is recognized, of course, that the bacterial count has other uses than in connection with filter plants, and that for some of these uses the 37° count is undoubtedly superior to the 20° count. It is better, for example, for studying the purification of sewage, the contamination of shell-fish, and for the analysis of milk. Possibly it would be wise not to have a single standard method for all of these purposes. At any rate it would appear to be advisable for the present at least, to employ in water analysis both the 20° and the 37° counts whenever practicable. This will require extra work, but if it is carried on systematically for a year, the data should be sufficient for determining whether the 20° count or the 37° count is most useful, or whether both should be constantly employed. Our laboratory section, through its committees, can confer no more useful service than to undertake such an investigation.

EXPERIENCES WITH STOKES'S BILE MEDIA FOR SENDING CULTURES FROM STOOLS, URINE, BLOOD, ETC., TO LABORATORIES.

J. P. Simonds,

Galveston, Texas.

Read before the Laboratory Section, American Public Health Association, Washington, D. C., September, 1912.

In 1910, Doctors Stokes and Stoner described an outfit for sending cultures from feces, urine, blood, etc., to laboratories to be examined for typhoid bacilli. The outfit consisted of a tube of sterile bile, a sterile swab, a small tin box containing cover slips for blood for the Widal reaction, all enclosed in a regulation double mailing case. During the past summer we used a similar outfit at the bacteriologic Laboratory of the Indiana State Board of Health.

The report of our summer's work does not pretend to add anything new or original to the bacteriology of typhoid fever or the infections of the gastro-intestinal tract. It is presented merely in the hope that it will call further attention to a very useful method—a method which will increase in usefulness now that the study of the epidemiology of typhoid fever in rural districts and the search for typhoid carriers have assumed such importance.

Ninety specimens of feces and one sample of blood were examined. Dilutions of cultures from stools were plated on Endo's medium as soon as received. The specimens of blood were first incubated for twenty-four hours and then plated in the same way. After twenty-four hours' growth colorless colonies were fished from the Endo plates and inoculated into plain broth. After twelve to twenty-four hours' incubation these broth cultures were tested for motility and smears stained by Gram's method. The pure cultures of motile organisms were reserved for the further study except in cases of suspected dysentery when all the non-motile and some of the motile ones were set aside. Sub-cultures of these reserved organisms were made in milk, Dunham's peptone solution, gelatine, and Hiss's semi-solid tube medium containing litmus and dextrose, lactose, saccharose and mannit, respectively. At the same time or later an agglutination test was made with a 1 to 10,000 dilution of a known typhoid immune serum having a titer of 1 to 100,000.

Of the 90 specimens of feces received, 78 were examined for typhoid and 12 for dysentery bacilli. Of the 78 cultures, 13 yielded typhoid bacilli

identified by the agglutination test and 6 contained organisms identical in morphology and cultural characteristics with paratyphoid bacillus B. Only one of these 13 cases gave a positive Widal test before the culture from the stool proved positive. Three of the 13 typhoid stools were from 2 carriers one of whom was the source of an epidemic of 7 cases with one death.

Of the specimens taken during the course of the disease, a larger proportion of those taken in the third and fourth weeks showed typhoid bacilli than at any other time. There were 4 positives out of 10 cultures in the third week and 2 positives in 7 cultures in the fourth.

One sample of blood taken on the eighth day and sent to the Laboratory in one of these outfits contained typhoid bacilli although a sample of the patient's stool obtained on the same day proved negative.

Of 12 cultures from cases of diarrhea in children, 4 contained organisms with the morphology and the cultural characteristics of B. dysenteriæ, 3 being of the mannit fermenting type and 1 of the mannit non-fermenting type. B. aërogenes capsulatus was isolated from 2 of the 12 stools. From one of these 2 other organisms were obtained, one resembling paratyphoid bacillus B. the other was morphologically and culturally identical with Morgan's Bacillus No. 1.

In our experience this outfit has proven very useful. While it may often furnish assistance in the diagnosis of typhoid fever, its greatest value is that it furnishes a method of searching for carriers in localities distant from the laboratory thus making it possible to trace epidemics of typhoid fever to their ultimate source, namely an individual who discharges typhoid bacilli in his stools or urine.

TOXICITY STUDIES WITH COAL TAR DISINFECTANTS.

WORTH HALE,

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Read before the Laboratory Section, American Public Health Association, Washington, D, C., September, 1912.

For years the general American public have been receiving a more or less superficial education in matters relating to hygiene, particularly as related to infectious processes and the destruction of germ laden material either by the use of heat or more commonly by the use of disinfecting solutions. As a result of such teaching, as well as by superficial experience in preventing infection, the lay public have become such general users of germicides that no family medicine shelf is complete without one or more substances belonging to this class of medicinal agents. Their use has been carried over also, from the destruction of bacteria to the destruction of grosser parasites, as fleas, lice and ticks, especially as they occur in domestic animals.

Thus it has come about at first upon the suggestion and under the direction of a physician and later through popular education that disinfectant solutions are to be found everywhere while familiarity has bred such a contempt for their usual poisonous qualities that few or no precautions are taken to guard against accidental or suicidal poisoning. This is particularly true in the case of the universally popular carbolic acid whether it be used in the form of pure phenol or as crude carbolic acid. Both have always been so easily obtainable and so carelessly handled that phenol probably outranks all other poisons combined in the number of cases of poisoning and death which have resulted from its use. It was largely on this account that attention was turned from the use of phenol as a disinfectant to its higher homologues, notably the cresols, the advantages claimed being that they were less toxic and even "safe" while at the same time they were more effective as germicides. Lysol introduced in 1898 was one of the first of a number of similar compounds of this type and although these were reputed safe many cases of poisoning resulted and these safe disinfectants were found to be almost if not equally as dangerous as phenol itself.

This use of the homologues of phenol later paved the way for the introduction of a large number of disinfecting solutions, closely allied to the phenol group, the so-called phenoloids which occur as condensation products in the manufacture of coal gas and coke. Recently solutions of these, which are said to be free from phenol and the cresols, have come into great

prominence as disinfectants and the market is now flooded with preparations which belong to this class of compounds. As in the case of the saponified cresols it is claimed that these preparations too, give a maximal germicidal effect with a minimal toxic action. Interested individuals even go so far as to claim that they are not poisonous but in this connection it might be well to recall the order of the British Privy Council which permits the unrestricted sale only of liquids containing less than 3 per cent. phenol or its homologues on the ground that in such dilution only is the liquid not poisonous. An extended study of the toxicity of the phenoloid disinfectants does not seem to have been made, however, and in view of the assertions that these higher phenol compounds were less toxic than phenol or, as exemplified in the advertising literature of certain firms exploiting disinfectants of this class, not poisonous, it seemed that experimental study might yield toxicological results of importance.

Certain isolated experiments with coal tar disinfectants indicated that at least some of them were sufficiently toxic to kill cats, guinea pigs and mice when given by the stomach, by subcutaneous injection and intraperitoneally. Their toxicity, however, when compared with that of pure phenol was found to be generally less, but in no case sufficiently less to even suggest that the term non-toxic could be correctly applied to them. In these preliminary experiments it was noted that the toxicity of different disinfectant solutions varied widely and in order to make a comprehensive study of toxicity a large number of the commercial coal tar disinfectants were secured from various sources. Most of the experiments were carried out on mice using from $2\frac{1}{2}$ per cent. solutions or emulsions to 20 per cent., the dilution depending on the toxicity as determined by preliminary tests with a 10 per cent. dilution.

The avenue by which the disinfectant should be given was considered particularly important as the practical value of toxicity studies on animals depends on their applicability to man. At first it seemed that the method of introduction through a stomach tube in cats or dogs would give the most valuable results from a practical standpoint as poisoning in man whether accidental or suicidal is usually from the stomach. Experimentally, however, this method of giving drugs is far from perfect where quantitative results are desired, since vomiting is a frequent symptom in the animals most available for experimental purposes, thus making it difficult to determine accurately the least fatal dose. Further, also, even when vomiting does not occur the results are complicated by the varying degrees of shock which follow the introduction of an irritant or corrosive poison. The subcutaneous method was adopted after a comparison with the results obtained in parallel experiments using both methods. It was found that the initial poisonous symptoms on the part of the central nervous system appeared about equally soon whether the disinfectant were given by the

stomach or subcutaneously. Finally the least fatal dose as determined in a number of preliminary parallel experiments is approximately the same.

Tests were carried out on cats, guinea pigs and mice, but mice were finally chosen for the quantitative toxicity experiments and the solution was given by hypodermic injection.

In general, the symptoms of poisoning were the same for all animals and without reference to the disinfectant used. The symptoms resemble those occurring after poisoning with phenol, but present some points of dissimilarity in that the symptoms from the phenoloid group are slower to appear. This indicates somewhat slower absorption, a difference which is more apparent on subcutaneous injection than when given by the stomach. The typical tremors of phenol poisoning are invariably present but are never so marked either in degree or duration and the animal dies during the succeeding paralytic stage, whereas, with phenol, convulsions often immediately precede death. The autopsies of animals dying as a result of the subcutaneous injection show no typical lesions, but it is noted in animals that recover that ulcers frequently develop at the site of the injection showing that destruction of tissue has taken place. In cats which have received a solution of the disinfectant by the stomach there are frequently evidences of extensive destruction of the gastric mucosa.

Thus it is seen that the coal tar disinfectants are toxic just as phenol is toxic. Any difference is largely a matter of degree and in order to secure a basis for estimating this the toxicity of all the disinfectants experimented with was compared with that of pure phenol given under similar conditions.

Only one disinfectant solution, a sample of tricresol, among the eighty studied was found which was practically as poisonous as phenol. Thus it was found that mice of 20 grams weight were killed as a rule by 0.9 cc. of a 1 per cent. solution of phenol. Tricresol was lethal in a dose of 1 cc. of a 1 per cent. solution. Four other disinfectants of the series were so actively poisonous that 0.8 cc. of a 2 per cent. solution was fatal and these in turn were more poisonous than Lysol which has held such an important place in the list of deaths from poisons. Lysol is poisonous when given in a dose two and one-half times that of phenol. In general, however, the toxicity of the commercial disinfectants is somewhat less than the above, the average having a toxicity about one fifth to one sixth that of phenol while a number are still less toxic the least toxic being about as poisonous as phenol in 4 per cent. solution.

These results were not entirely a surprise in spite of the claims of a large number of manufacturers to the contrary, for it seemed unlikely that compounds so closely related to a very toxic substance like phenol should prove non-poisonous. Among the first fifty disinfectants examined nineteen are labeled non-poisonous, safe, a harmless substitute for carbolic acid, safe in the hands of the most timid, etc. Another, tricresol, is

labeled one third as toxic as phenol. Tricresol is practically as poisonous as phenol and this agrees with the results of Tollens who worked with the isomers ortho, meta and para cresol. With regard to the nineteen so-called non-poisonous disinfectants much less credit can be given to the firms who are responsible for the obviously misleading statements appearing on their labels—for at least half are decidedly toxic and all are more toxic than the 3 per cent. phenol allowed by the British Privy Council.

The ratio of toxicity and the phenol coefficient as determined by the Hygienic Laboratory method do not run parallel although there is a very general relation. Thus the disinfectants with a high phenol coefficient were usually very toxic while those with a very low coefficient were usually only mildly poisonous.

In conclusion, it may be said that the coal tar disinfectants of the phenoloid group are considerably less toxic than either phenol or the cresols, but they are not harmless non-poisonous substances and on an average have a toxicity equal to about 20 per cent. phenol. Manufacturers and retailers accordingly should be required to revise present labels and to designate such products as toxic by the use of suitable poison labels. Until this is done physicians and health officials who recommend disinfection should warn the general public of the danger of such solutions and urge upon it greater care in storage than is now common practice.

A PLAGUE-LIKE ORGANISM FROM A RAT.

Read before the Laboratory Section, American Public Health Association, Washington, D. C., September, 1912.

SURGEON JOHN F. ANDERSON, *Director Hygienic Laboratory*
and
P. A. SURGEON ALLAN J. MCLAUGHLIN, *U. S. Public Health Service.*

The proximity of plague to our Atlantic seaboard makes it essential to determine whether plague infection exists among the rodent population in our seaports.

The examination of rats found dead, trapped or poisoned is not a simple procedure, and the diagnosis of plague in rats requires some little care in excluding other organisms. Some of these organisms may produce lesions in rats very much like plague, and may resemble B. pestis morphologically. It is especially necessary that care be taken to exclude suspicious organisms in cities where plague infection has not existed before. A false diagnosis causes unnecessary alarm, and great damage to commercial interests may ensue.

There are certain diagnostic lesions which are looked for in rats dead of plague, such as the dusky injection of the skin, the characteristic buboes, the granular liver, the large dark spleen and pleural effusion.

It is probable that these five cardinal lesions would never be found co-existent in any infection other than plague. Some of them are found, however, in animals dead of other infections, and as we find animals dead of plague with two or three of the typical signs absent, confusion may readily occur from gross post-mortem findings alone. Some of these organisms show a morphology not unlike plague, and while one would not base opinion on morphology alone, the presence of bipolar-staining bacilli in a smear from spleen or liver is suggestive of plague to say the least.

In view of these facts it seems pertinent to report an investigation of a suspected plague rat made by one of us at Key West, Fla. Doctor Anderson's report is as follows:

"Upon my arrival in Key West I at once called upon Dr. R. L. Benson, bacteriologist of the State Board of Health of Florida, who was in charge of the State Health Laboratory in Key West. Doctor Benson gave me the following history of the rat:

"The rat was caught on July 22 at a house situated on White Street, between Petrona and Olivia streets, this location being somewhat remote from the docks. The rat was noticed to be slowly crawling across the floor of the dwelling and was kicked and killed by a boy residing therein.

It was brought immediately to the laboratory and the following is from Doctor Benson's notes:

"*Autopsy.*—Hair almost entirely gone. Upon reflecting the skin over the chest and abdomen no subcutaneous injection; slight injection and enlargement of the inguinal glands on both sides; lymph glands in other portions of the body apparently normal; lungs apparently normal except for a nodule in the right lung which contained a mucoid-like material; small amount of yellowish fluid in the pleural cavity. Liver showed fine yellowish spots quite numerous, and in addition several yellowish areas. Spleen dark and slightly enlarged.

"Cultures made from the lung nodule, liver and spleen showed a cocco-bacillus apparently in pure culture. No direct guinea pig inoculations were made. A guinea pig was inoculated July 26 by the cutaneous method from culture made from the suspected rat, and died July 29; at autopsy under surface of skin was found to be slightly reddened but no general injection; inguinal glands slightly enlarged and hyperemic, other glands apparently normal; liver yellowish, the left margin of inferior surface showed an oval yellowish area; the anterior surface showed yellowish spots about the size of a pea; the left lobe of the liver was thickly studded with pinhead-size yellowish spots; spleen very dark but not enlarged.

"Cultures made from the spleen and liver on agar showed the same bipolar staining cocco-bacillus that was noticed in the smears made from the suspected rat.

"In addition to the inoculation of this guinea pig Doctor Benson inoculated other animals from the first guinea pig and had, on my arrival, obtained the organism in pure culture.

"Immediately upon my arrival, cultures were made upon glucose-broth, lactose-broth, salt-agar, and neutral agar.

"Guinea pigs and white rats were inoculated, some subcutaneously and some cutaneously. Some of the animals, in addition, received anti-plague serum. In twenty-four hours examination of the cultures showed the absence of involution forms upon salt-agar; profuse and heavy growth upon salt-agar and neutral agar, the formation of gas with acidity in glucose-broth; a growth in lactose-broth without change in reaction.

"A guinea pig inoculated subcutaneously, and which had not received any antiplague serum, showed distinct evidence of illness within eighteen hours after inoculation and died in about twenty-eight hours after inoculation. At post mortem the findings were in no way typical of plague.

"The white rat inoculated with a subcutaneous injection and which had also received antiplague serum, died in about thirty-six hours after inoculation—some hours before the control animal which had received no antiplague serum.

"Based on the above findings, the opinion was arrived at that the organism isolated from the suspected rat was not the plague bacillus."

Doctor Anderson was able to exclude plague quickly by the use of glucose-broth and salt-agar. Upon his return to the laboratory Doctor Anderson gave me a culture of the organism, and I have been able to confirm his findings.

The organism is an actively motile rod with a tendency to bipolar-staining. It produces gas and acid in glucose, but neither acid nor gas in lactose, which places it in the B. Enteritidis (Gärtner) group. Its action on various media is identical with B. Enteritidis (Gärtner). It gave no involution forms but grew luxuriantly on salt-agar.

To identify or separate this organism from Paratyphoid B., and B. Enteritidis (Gärtner) would require the preparation of sera for cross agglutination and the Castellani saturation experiment, procedures which were not possible for lack of time.

THE LIMITATIONS OF THE PHENOL COEFFICIENT IN THE STANDARDIZATION OF DISINFECTANTS.

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Read before the Laboratory Section, American Public Health Association, Washington, D. C. September, 1912.

A disinfectant may be tested by the determination either of its absolute germicidal effectiveness under stated conditions, or of its relative effectiveness with respect to some other disinfectant. The one method gives its absolute germicidal power, the other its relative power or germicidal coefficient with respect to the other disinfectant. The phenol or carbolic coefficient, due to Rideal and Walker is the best known example of the latter method and the term standardization of disinfectants has come to mean the comparison of the strength of any disinfectant with that of phenol under certain standard conditions.

If such phenol coefficients exist, their determination, for a series of disinfectants, would be of greatest commercial and economic value. Unfortunately there is abundant evidence that no such constant relation between the efficiencies of any two disinfectants is determinable. The absolute germicidal power of a diluted disinfectant depends, for example, upon the concentration, that is, the amount of disinfectant in the solution, but it is seldom directly proportional to the concentration. The efficiency of one germicide may vary directly as the concentration of another as the sixth power of the concentration. Obviously then, there can exist no "coefficient" which will state the relative values of these two. Doubling the amount of the disinfectant will double the efficiency of the one and increase that of the other by 64 changing the ratio or coefficient 32-fold. This, it is true, is an exceptional case in that disinfectants of widely differing types are represented—mercuric chloride and phenol—but that such extreme discrepancies are not noted in every-day practice is due wholly to the fact that our investigations are concerned largely with coal tar distillates of very similar chemical properties.

There are numerous other factors, such as temperature, time of contact, etc., which affect the actual germicidal powers of any two disinfectants disproportionately. Consequently if these be varied, the "coefficient" or relative value necessarily varies. The effect of concentration cited will serve as an example of the indeterminate character of the phenol coefficient or of any other similar ratio. In general, the germicidal powers

of two disinfectants, although affected by varying physical conditions, are not similarly affected, so that varying conditions give a varying ratio of these two germicidal powers, or, in other words, a varying coefficient.

It is interesting now to see what cognizance is taken of these matters in the Rideal-Walker coefficient as determined by the various methods that have been proposed. The first essential in a "coefficient" is that it shall be constant for a given pair of disinfectants, and the fact that the ratio between the efficiencies of two germicides under varying degrees of concentration, temperature, etc., necessarily varies, might appear to be a serious bar to the determination of such a coefficient. Such was found to be the case and it has become necessary to limit these physical conditions one by one as each new variable has asserted itself. The latest result is the most excellent technique recently reported by Anderson and McClintock. This leaves little to be desired in the matter of refinement and control, and if phenol coefficients are to be determined, one most heartily endorses some such method. All variables are carefully eliminated even down to the test organism,—not only the kind of organism but the lineage of the strain being specified.

But suppose, in actual practice, germicides should be used on ordinary typhoid germs, not of the Hopkins ancestry, or even upon tubercle bacilli, on car floors. In general, suppose the practical conditions are in any way or in many ways unlike those under which the test is made. In attempting to fix the non-existent "phenol coefficient" by the successive elimination of variables, have we not lost sight of the primary reason for all this work, the valuation of disinfectants?

For answer let us define a phenol coefficient. In their excellent paper upon the Standardization of Disinfectants,[1] Anderson and McClintic do not define the coefficient in so many words, but in their discussion of cost and valuation, it is implied that a disinfectant with a coefficient of two is twice as valuable as phenol, i. e. may properly command twice the price. Conversely, at the same price, the cost of the disinfectant per unit of efficiency is one half that of phenol. One is justified then in regarding the Hygienic Laboratory phenol coefficient as the relative efficiency of the disinfectant in question compared with phenol. The same definition might apply equally well to the Rideal coefficient, yet the two coefficients may vary widely. Is this then a fair definition of the result of the specific test by which the coefficient was determined? Obviously it is not. A coefficient must bear all the restrictions that have been imposed. Under the exact conditions prescribed, starting with the Hopkins typhoid cultures 24 hours old, in extract broth, previously transplanted on three successive days by carrying over each day one loopful

[1]Pub. Health and Marine Hospital Service Hyg. Lab., Bull. 82, 1912.

of a 4 mm. platinum loop to the final observation of the weakest dilutions which kill in 2½ and fifteen minutes respectively; every move is carefully planned to protect the test against just those variables that ought to be encountered and determined.

A coefficient is eventually obtained and with sufficient care may be duplicated, even by other workers, but the manner of its birth must not be forgotten. It is not the relative efficiency in general terms. It is the relative efficiency under one of the thousands of possible combinations of all the variables, namely, the particular conditions imposed by the technique of the test. With other techniques, equally worthy of adoption, widely differing values would result, all having equal claim to recognition.

Surely no fundamental significance can attach to these phenol coefficients when an entirely new series of values would result from the adoption of:

(a) Another strain of typhoid organism or even the same strain grown under other conditions;

(b) The use of more or less of the culture in the test, or its equivalent, the use of a culture not twenty-four hours old;

(c) The adoption of another standard time for the duration of the test.

Anderson and McClintic give an interesting example of the last named point. They determined coefficients at 2½ and 15 minutes. The latter is at times twice the former; in one quarter of the cases it is over 50 per cent. greater; and in all the 81 cases it averages 32 per cent. greater. By the Hygienic Laboratory coefficients, with organic matter, trikresol (2.50) is more efficient than sulpho-naphthol (2.33) in the ratio of 1.07; with the three minute coefficient the ratio becomes 1.25, while with the 15 minute coefficient, the superiority is reversed in favor of sulpho-naphthol in the ratio 1.11; a total difference of 36 per cent. in the comparative valuation of these two disinfectants. One of the most powerful disinfectants reported gave a value of 7.50 at 2½ minutes and 12.22 at 15 minutes. Manufacturers might seriously and very properly object to the arbitrary selection of any particular time factor under these circumstances.

The authors themselves show that a variation of 33 per cent. is possible if the selection of the time factor be left to the bias of the operator. No good reason, however, appears for the arbitrary selection of any standard time of testing and the recorded facts show clearly that the resulting coefficient is quite dependent upon the particular time selected. With some disinfectants, the influence of time is slight or nil, with others it is great. Hence varying times affect the final coefficient of two disinfectants differently, and one or the other may have the greater "phenol coefficient" according to the time actually adopted as standard.

Unfortunately the conditions of practice may be quite remote from the

standard conditions of the test and the true relative values under the natural conditions of use may be equally remote from the phenol coefficient as determined. In the cases just illustrated, one would ordinarily give more weight to the 15 minute coefficient than to the 2½ minute value or to the average.

The limitation of the phenol coefficient is nowhere more plainly shown than where it is applied in practice. The most obvious application of a coefficient lies in determining relative costs of disinfectants. At the same price per gallon, a disinfectant with a coefficient of two costs half as much per unit of disinfecting power as phenol or another disinfectant, having a coefficient of one. If the coefficient be two, under specific conditions of concentration, temperature, time of contact, etc., and may become one under other specific conditions, then relative costs vary to the same extent. If the coefficient be two for typhoid bacilli, it may be only one for pus organism; a second disinfectant may have a reverse relationship. Grave injustice would be done by assigning costs to these two based on typhoid tests if in practice the cocci were the organisms to be destroyed.

Whatever then may be our attitude on the value of testing disinfectants, one must strongly protest against the application of this highly specialized "coefficient" for the determination of the cost of disinfectants per unit of disinfecting power, that is, their valuation.

The carbolic coefficient of Rideal with its varied modifications is now so well known and so generally used, and represents such an important step foreward, that one might hesitate to oppose its use in the absence of any alternative.

The writer has published elsewhere[1] a contribution to this subject in which the more fundamental theoretical and bio-chemical aspects of the problem are discussed. Instead of eliminating variables, the more important of them which had any theoretical basis were included in the study. As a result, three factors were evolved which relate to the absolute, not relative, efficiency of the germicide under a wide range of conditions.

These covered the more important physical and chemical conditions of practice and by them a given disinfectant is rather fully defined as to its action under all variations in these conditions. This study is a part of a purely theoretical investigation in chemical biology and its application to the practical problem of testing disinfectants is only incidental. The certainty with which it demonstrated the non-existence of a single phenol coefficient (as well as of a thermal death point and many other sacred concepts of bacteriology) seemed to justify an attempt to apply it to this problem. It is difficult to understand in principle and requires

[1] Journ. Inf. Dis. 8, 1911, 27.

further development in technique. Giving three or more final terms of comparison, it does not permit generalized cost efficiency calculations or even facilitate comparative valuation of two disinfectants. On the other hand for known conditions of practical application these three or more factors indicate clearly the relative efficiencies of a series of disinfectants.

In conclusion the writer wishes to express his great admiration of and respect for the work of Rideal and Walker, Anderson and McClintic and others in this field. They have gradually brought the technique of this difficult test to a high degree of perfection. Until the refinement of practice necessitates a more complete and less arbitrary method of comparison the phenol coefficient will undoubtedly be widely used. With a full knowledge of its limitations and of the fundamental facts which underlie them, it can be used to much good purpose. It is only with an earnest desire to place these limitations upon the record that this contribution to an important subject is submitted.

Sanitary Research Laboratory. Mass. Inst. Tech.

THE COMMON HOUSE ROACH AS A CARRIER OF DISEASE.*

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Read before the Laboratory Section American Public Health Association, Washington, D. C., September, 1912.

During the past six summers, when a little time could be stolen from the routine service, a number of experiments were made with the common house roach, as one of the insecta class belonging to the phylum arthropoda, the six-legged type of house insects.

As these common house roaches feed upon all kinds of bread stuffs, milk and its products, water, clothing, cooked foods, migrate from one apartment to another following water and drain pipes, from cellar to living rooms, intermingle with others of their own and other types of insects, I selected these for the few limited experiments, of which I make a preliminary report.

Limited time will only admit of the most brief mention of the findings from these studies, all technic and details must be excluded, the actual results only recorded. Among the first experiments made with the common house roaches, was the placing of four in different sterilized flasks, allowed to remain for forty-eight hours, then removed, and nutrient bouillon run in, incubated.

The resulting growth plated out on different media, resulted in the demonstration of the B. coli communis, B. proteus vulgaris, staphylococcus aureus and citreus and a bacillus of the subtilis type.

This indicated that the roaches carry infection on their legs and feet, and the problem of what their feces contained was next considered, and ten roaches secured, the legs of five removed, dropped in nutrient bouillon, the flasks numbered, and each roach dipped in bichloride solution, dried in sterilized flasks, the body opened, and with the platinum needle loaded with the visceral contents, flasks of bouillon were inoculated, numbered, so that each set of legs and its body, could be investigated.

The same general type of bacteria was developed, isolated and identified in the plates of both the legs and visceral contents of each roach, but in the visceral content of roach number 4, a streptococcus was isolated, that hemolyzed human blood, thus proving its virulency.

These results indicated that the bacterial content on the feet was the same as in the feces, and to ascertain if the roaches devour the feces of one another if starved, the following experiment was tried.

*From the Toledo Clinical Laboratories.

Ten roaches secured, kept in sterilized flasks, and at end of the third day, five were fed upon few drops of a bouillon culture of B. typhosus, then placed in setrilized flasks for three days.

Meantime, the flasks of the other five roaches were washed with bouillon, and plates gave no cultures of B. typhosus.

The control roaches were placed in the five flasks that had contained the five roaches fed upon the bouillon, with no food, and allowed to remain for three days, their feet and visceral contents of each roach on plates gave the B. typhosus with other ordinary bacteria previously found.

This experiment proved that the roaches when starved, or not starved, will feed upon the feces of their own type of insects and not unlikely, of all other types met with in their migration from one locality to another.

To ascertain further, the possibilities of infection carried by the house roaches, ten roaches were secured, five were kept as controls, all secured from one source and pantry. Five roaches in different sterilized flasks were fed upon coagulated, sterilized egg albumin, inoculated with a Wesbrook's type of B. Klebs-Loffler, sent me few years ago by Dr. William Royal Stokes, from his laboratory cultures. From the legs and each of these five roaches fed on the inoculated egg albumin, the Wesbrook's type of diphtheria bacilli were recovered, and from the five control roaches, no bacteria of the diphtheritic type were demonstrated.

In like manner, five roaches and five control roaches were fed upon sterilized bread, inoculated with streptococcus pyogenes longus, and this type of streptococcus recovered from the legs and visceral content of each roach.

That the virulency of the streptococcus was not diminished by its passage through the roaches was proved by the hemolysis of the culture before being fed to the roaches and the recovered strain was unattenuated.

Chromogenic bacteria were next tried, the prodigiosus, the violaceus, the pyocyaneus, the controls free from these bacteria, and the inoculated roaches demonstrating these individual bacteria from both the feet and visceral contents, associated with other ordinary bacteria.

More difficult were the experiments with the pneumococcus, but small bits of a blood agar culture were exposed to ten roaches, whose previous cultures from feet and feces were negative to the pneumococcus.

Sterilized camel's hair brushes, dipped in warm, sterile water, washing off the feet and abdomen of each roach, streaking the surface of plates, the media being sheep serum, human blood with 1 per cent. glucose, coagulated, sterilized by lower temperature for longer period.

Of the ten plates inoculated, but three demonstrated pneumococcus colonies, with the other ordinary bacteria. The bodies of the ten roaches after being opened up and smeared along the surface of similar plates,

resulted in from few to a number of pneumococcus colonies from each body.

Similar experiments were tried with the meningococcus, but while few plates demonstrated a colony now and then, the results were not as decided as with the pneumococcus, probably due to the meningococcus being so easily killed and the body warmth of the roach less than required to grow this type of bacteria.

I have not had the time nor opportunity to investigate the possibility of other pathologic bacteria, but have proven that the common house roach does and can carry all of the common pathologic bacteria of the acute infectious diseases, as well as any bacteria that can be met with in the roach's travel, and any bacteria that can survive the environments of the roach's diet and habits.

These house roaches, or any of their type of wandering insects, living as they must on what they find, feeding upon all kinds of food, depositing their feces along the route, gathering up all kinds of bacteria on their feet, feeding as is shown on the feces of their type and others, become laden with all types of pathologic bacteria.

All the bread stuffs, milk and its products, cooked foods in open dishes, in cellars, pantries, shelves, kitchens, are open to these wandering roaches, which passing over the foods, leave deposits from their feet and feces, bring direct to the consumer, any or all pathologic bacteria that a roach may encounter in his journey.

The temperature of the months that render the roaches active, is also favorable to the growth on some cooked foods, milk or vegetables that are eaten raw, of any or all bacteria deposited.

Those vegetables, foods, meats that are cooked, just before eating are harmless because of the sterilization during cooking, but especially are the dangers of these roaches about the restaurants and hotels, which are never without them the year round.

I have never had the opportunity to investigate the roach and some parasites, which is an unknown question, as regards some of the pathologic types and may not be a source of danger.

This brings up an important matter as to the transmission of B. tubercle, from sputa deposited in damp, dark places in cellars, kitchens and restaurants, more than in private residences.

Such transmission of B. tubercle, taken up from sputum, deposited by both the feet and feces of the roach on certain cooked foods, which are eaten without again being heated, as so often occurs in the summer months is entirely within range of possibility. It seems a question of whether the roach will feed upon the sputum, may not unless starved, yet may live upon the sputum, wherever found in its wanderings. Whether the environment of the roach's viscera is favorable to the living B. tubercle,

I am not able to say, but might be worth investigation. The common house fly, loaded with all kinds of bacteria, benign and pathologic, coming in from the street dirt and manure, to sit on and walk over our food stuffs, water pitchers or sugar bowls, offer no more danger from acute infectious diseases than does the common house roach, running over our foods, vegetables, breads, cakes and water utensils, and should be as thoroughly exterminated as the mosquito.

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THE BACTERIOLOGICAL EXAMINATION OF FOODS WITH SPECIAL REFERENCE TO GELATINE.

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Read before the Laboratory Section, American Public Health Association, Washington, D. C., September, 1912.

The examination of food substances may be carried on from two standpoints, first, to determine if adulteration has been effected, or if the food presents a normal tissue or cellular appearance and the proper percentage of the ingredients entering into its composition; second, to determine if it is in a condition such that it is wholesome, undecomposed, and free from organisms which may either be harmful in themselves or may cause putrefactive or fermentative change of such a nature as to impair the food value of the substance if development takes place.

Chemical and microscopical methods of examining foods for adulterating substances and for normal appearance have been in use for many years and have reached a high degree of accuracy in many instances. Unless decomposition is well advanced, however, chemical examination fails to reveal the changes induced by microörganisms and hence this method of investigation fails to be of great service in determining the early stage of putrefactive or fermentative decomposition.

For many food substances bacteriological examination offers a means of determining the true character of the food with greater certainty than does the chemical analysis. For example, chemical analysis will show if a sample of milk or butter contains the legal requirements of fat, or an excess of water or the presence of preservatives. It fails, however, to indicate the presence of undesirable types of bacteria, knowledge of which is of far greater importance from the standpoint of health than is the percentage of fat, and the finding of which in large numbers is in itself evidence of the absence or negative action of preservatives. While fully recognizing that the chemical methods of food examination are most necessary and always desirable, we wish to point out that bacteriology may supplement chemistry in a most useful way, and may frequently supply the chief really important facts relative to the fitness of substances for foods, as, for example, the bacteriological examination of oysters. Likewise, valuable results may be obtained in the examination of sausage, cheese, canned goods, meats, and many other food substances in which it is suspected that undesirable changes are being effected, providing knowledge of the normal condition of these foods is available as a sort of a base line for comparison, from which reasonable and safe deductions

may be made. In canned goods, for example, the mere presence of bacteria is indicative of imperfect preparation and sterilization.

Among the substances used for food, in which bacteriological examination is of importance, gelatine occupies at present a conspicuous position. Although actually low in nutritive value, this substance, by much advertising and because of its adaptability to various culinary uses, has advanced from a mild adhesive and now occupies a position as a commodity in very general use. Notwithstanding this, or rather because of this widespread use, its manufacture from bones, pieces of skin, trimmings from hides, etc., makes it of special importance that we may be certain that objectionable organisms associated with the animal body, such as B. tetanus, B. coli, etc., are eliminated. Bacteriological examination of gelatine therefore becomes a necessity to the manufacturer, who wishes to maintain a high grade product, and to the food inspector whose duty it is to safeguard the public. Owing to the ease with which many bacteria decompose gelatine, it is also of importance to the manufacturer to know whether his product will stand intact under all conditions met in commercial practice.

The bacteriological examination therefore may be carried out from two apparent standpoints. First, the health standpoint; second, the commercial standpoint. In reality the aim in both cases is the same, namely, to determine if the gelatine is low in numbers and free from objectionable types of bacteria.

Owing to the prevailing methods of gelatine manufacture,—methods which are in a measure controlled by the physical properties of the product, it is almost or quite impossible to obtain gelatine in a germ-free condition without resorting to the use of strongly germicidal substances. We cannot, therefore, assume that a pure gelatine is one which is germ-free or vice versa, that a germ-free one is necessarily pure.

The Manufacture of Gelatine.

Edible gelatines are made from trimmings from hides, bones, either raw or treated, dentelles, horn piths, etc. In America much of this material is imported and is of such a character that it may be more or less infected with bacteria of various types, including B. tetani.

This material is subjected to a long continued liming treatment after which it is thoroughly washed, the excess of lime removed by acid and again washed. The material is then ready for the boiling kettles where, by treatment with steam, the ossein or collagen is hydrolized into gelatine which is dissolved. Care is taken to avoid excessive or too long continued heat. After the removal of the gelatine thus extracted the process is repeated at a slightly higher temperature. The highest grades of gela-

tine are the ones best for food purposes and are obtained in the first run or boiling, although gelatine from the second treatment is also used for food purposes. Mixtures of gelatine from different sources are made by some manufacturers in order to obtain a fairly uniform product. The extracted material is then strained and goes at once to the evaporator where it is concentrated under reduced pressure until of approximately 10 to 12 per cent. solution. After thorough mixing and filtration it is cooled either by surrounding by cold water or by refrigeration after which it is cut into sheets and dried.

Possibility of Infection in Process.

The early stages in the preparation of gelatine are essentially germicidal in character. The lime destroys many bacteria resident upon the raw materials and the acid treatment continues their destruction. Survivors of spore-forming types succumb almost completely in the boiling kettle, so that the product at this stage of the process may be regarded as practically sterile. After the concentration, however, infection may take place if the gelatine is subjected to unclean apparatus, dirty methods of handling and contamination from water or air. Thus a dirty unsterile filter may seed the gelatine with bacteria, or the use of distributing pipes not steamed out constantly with live steam may supply the first portion of a batch with innumerable bacteria while the last portion would pass through practically unaffected. Similarly, handling in the cooling and the cutting rooms may add its quota of organisms.

The Effect of Time.

Even in gelatine which has been carefully prepared and reaches the cooling room with a very low bacterial content, or nearly sterile, the process of cooling to the proper solidity is likewise a process of incubation. In passing from the high temperatures to the lower ones the mass of material requires a considerable time so that it may be, and generally is, held for several hours at a temperature favorable for bacterial development. The result is that from this time until the drying has brought the concentration to an inhibitive point the germs are increasing more or less rapidly in the medium, and their number is being augmented by infections from the air and from the hands of workmen. In view of all these possibilities, therefore, it is to be expected that gelatine which is itself so easily utilized as food for microörganisms should contain considerable numbers of bacteria and a more or less varied flora.

Methods of Examination.

In the work which has been used as the basis of this paper both quantitative and qualitative results were obtained. A study of the problems

involved led to the conclusion that the most reliable quantitative figures were those obtained by growing on standard agar at 37 degrees C. with an incubation period of two days. Anaërobic methods were found to add nothing of value in this respect. For inspection purposes and to maintain this work in line with that done on other foods, milk, oysters, etc., determinations of the approximate numbers of gas-forming types have also been made, dextrose broth and lactose bile being used for this purpose. For all this work the standard amount of material taken was one cubic centimeter of the melted jelly in the investigation of the different steps of manufacture. In the examination of the finished product results were based on the gram weight of material, but for greater accuracy in work, solutions were made using five-gram samples and dilutions from these prepared. At the outset it will be found that samples even from the same lot or batch will give great variations, hence the necessity for care in sampling and for thorough mixing.

Quantitative Results.

A large number of determinations of bacteria in different samples of gelatin have been made, the results of which need not now be given in detail. Here it will suffice to show the approximate number of bacteria found at different stages in the manufacturing process:

From the kettles,	10 to 500 per cc.
From the filters,	5 to 50 per cc.
Hose at cooling room,	5 to 100 per cc.
From solidified gelatin,	1000 to 100,000 per cc.
Green sheets after cutting,	2000 to 200,000 per cc.
From dry sheets,	Numbers very variable, depending upon conditions, ranging from a few thousands to many millions in exceptional cases.

General Conclusions.

From the standpoint of gas production in lactose bile and dextrose broth it is worthy to note that the fermenting or gas-forming types of organisms are almost always present in small numbers even in the early stages of the process. Compared with the total numbers of bacteria found they are in general very few. Even in the materials directly from the kettles they may be found indicating that they are resistant to heat if not actually spore-forming. The occurrence of these fermenting types suggests the presence of organisms of the colon type, indeed there has been a tendency to call such organisms "colon bacilli" and to regard them as indicative of pollution. On this point we have concentrated a great deal of attention

and have come to the conclusion that true colon bacilli, while frequently present, are not *constantly* present in large numbers, at least they do not occupy a more prominent position than some other types. As a result of the detailed study of about seventy-five cultures we have classified the bacteria found in four groups.

Group I. In the first group may be placed organisms giving all the usual colon reactions, showing from 30 to 75 per cent. gas in lactose bile and from 25 to 100 per cent. gas in dextrose broth. Both communior and communis types were isolated and are here grouped together.

Group II. This we regard as the most characteristic group of gas-forming bacteria occurring in gelatin. The organisms of this group grow vigorously on all media, simulate colon bacilli in the growth of agar but liquefy gelatin, fail to reduce nitrates to ammonia and fail to produce indol. The gelatin liquefaction is very rapid, frequently taking place within twenty-four hours, considerable variation is noted in the production of nitrites, motility and growth on potato.

Group III. This group consists of bacilli which liquefy gelatin, form spores, produce no gas in dextrose broth, lactose broth or lactose bile but produce acid in milk, reduce nitrates and give a positive indol test.

Group IV. Here are included all the coccus forms found, for the most part staphylococcus. These produce no gas, but do form indol, reduce nitrates, give acid in milk and generally liquefy gelatin. These are frequently very numerous and may even be the predominate types so far as actual numbers are concerned.

This grouping of the organisms found is subject to revision, and further work is in progress, especially in the hope of clearing up the doubt which may now exist in regard to the gas-forming species.

PATHOLOGICAL DANGERS TO DOMESTIC ANIMALS FROM CONTAMINATED STREAMS.

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In gathering data for this paper, 114 letters of inquiry were sent out; 40 state boards of agriculture, 10 agricultural experiment stations, 4 live stock boards, 48 state boards of health, and 12 individuals, who it was believed possessed particular information on the subject, were addressed. The replies came from every state in the Union, and were from 32 state boards of agriculture, 10 agricultural experiment stations, 4 live stock boards, 42 state boards of health, and from 11 of the persons from whom information was sought.

The responses of the state boards of agriculture and of the live stock commissions betoken great interest, but few of these boards have been active in investigating the subject.

Poisoning of animals, supposedly from drinking stagnant water containing hemlock (cicuta), is reported by the Colorado Board of Agriculture.

Outbreaks of anthrax have been traced to streams pollution by investigators in widely separated parts of the country. Ravenel, in the transactions of this Association, p. 303, vol. 24, 1899, gives an interesting account of a series of cases that were caused by the effluent of a Pennsylvania tannery, and he, also, has a report on the subject in the *Philadelphia Medical Journal* of April 22, 1899. The State Board of Agriculture of Delaware states that it is believed the effluents from the morocco factories in Wilmington, Del., and Camden, N. J., were the cause of the prevalence of anthrax on both sides of Delaware River and Bay in Delaware and New Jersey. These eruptions are described by Professor Neale in the Fifth, Sixth, Seventh, Eighth and Ninth Annual Reports of the Delaware College Agricultural Experiment Station, 1892–1897. According to these reports some of the outbreaks were caused by the floating ashore of disease virus, presumably from the carcasses of animals that were thrown into the river. Russell, in the Seventeenth Annual Report of the Wisconsin Experiment Station, pp. 171–184, 1900, describes an outbreak of anthrax that occurred in the vicinity of Medford, Wis., and was limited to the banks of Black River. The virus of the disease undoubtedly came from tannery refuse and was probably due to the use of infected hides from China.

Moore, in *Bulletin 141*, Nov. 1897, of the Cornell University Agricultural Experiment Station, describes a disease that occurs amongst swill-

fed hogs, is similar to hog cholera and is caused by the free alkali, sodium carbonate, contained in some powdered soaps. Ravenel, by letter, states that he has seen an instance of the same thing, where the waste from a hotel caused the disease, but that the case was never published as it was not fully worked out.

Wastes, incident to mining, by many state boards of agriculture are reported to be harmful. The Montana Board writes that in Deer Lodge and Silver Bow counties smelter slums, in numerous instances, have killed both cattle and horses. Conditions in these counties are described by Salmon.[1]

The Arizona Agricultural Experiment Station, on p. 497 of its Fifteenth Annual Report, 1904, details the killing of cattle near Cochise, Ariz., by lead poisoning. The animals drank from the tailings pond of a quartz stamp mill.

The New Mexico Agricultural Experiment Station reports the poisoning of cattle by lead and arsenic from the effluent of the concentrator of a lead mine near Las Cruces.

The South Carolina Board of Agriculture states that the effluent from the chlorination plant of the Hale Gold Mine did so much injury to cattle that the mine was closed down by injunction suits brought against it.

The Washington Agricultural Experiment Station says that the only record of even alleged injury to cattle would be in the suits for damages from the tailings of the Coeur D'Alene lead mine, but doubts if the records are available for public consultation.

The Department of Agriculture of Alabama, through the state veterinarian, Dr. C. A. Cary, reports that complaints are received that the wastes from mines and factories contaminate creeks into which they flow and injure cattle that drink these waters. The accusations have never been investigated.

As a whole, the replies of the state boards of health indicate that these bodies have not been active in investigating the effect of streams pollution on the health of domestic animals. Undoubtedly, in many states, the live stock industry is not large, and more pressing problems than this engage the attention of the boards. Some boards indicate that they consider the question important, and that they are planning to investigate it in the near future. Other boards lack the power to do so. This appears to be the case in Tennessee; in Maine where the state board of health has not been entrusted with control of the water supplies, and in Minnesota. Of the last named state, Doctor Bracken says that the state board of health has control of waters used for domestic purposes

[1]Am. Veterinary Review, Vol. 39, Nos. 1, 3 & 5, 1911; Vol. 40, Nos. 2, 1911, 5 & 6, 1912; Vol. 41, Nos. 2, 3 & 4, 1912.

but that, though the question has often been raised as to what "domestic" means, no authoritative legal interpretation has been given it. The doctor is inclined to believe that the courts would not hold that "domestic" use means use for domestic animals. He says that he has always considered a polluted stream as unfit for domestic animals to drink, and that farmers have a case at law against parties polluting such a stream.

This is the belief of John W. Hill, who writes that it is his opinion that the farmer owning land bordering a stream, under his riparian rights, is entitled to receive the water on his land in its best natural condition; that is to say, that in the development of towns and cities the settlers have no right to impair the quality of a stream of water to the detriment of the farmers.

Prof. C. N. Kinney, state chemist of Iowa, has been called in a number of damage suits occasioned by the pollution of streams by towns and corporations. In a letter he says that the evidence in these cases tends to show that the effect of polluted water is especially marked on the health of cattle; the creatures become thin and scrawny, and seem to lose appetite rapidly, and the young stock seems not to grow as it should. He mentions a suit against Grinnell, Iowa, for polluting a stream and injuring cattle thereby.

The State Board of Health of Louisiana says that the streams in that state are so large, and the amount of pollution so small, that the problem is not pressing; while the Oregon Board is of the opinion that it will be fifty years before the question becomes important in Oregon.

In Kansas, suits have been brought against two municipalities, Cherryvale and Seneca. The former case was decided against the city but has been appealed. An oil company was joint defendant, and, in the opinion of the attorney for the city, it was not determined how far the oil waste and how far the effluent from the city purification plant injured the cattle. The latter case has not been settled.

In Idaho a complaint that the effluent from the bleach silo of a sugar factory was harmful to cattle was investigated by the state board of health which decided that the complaint was unfounded.

Theodore Horton of the New York State Department of Health writes that the board has frequent complaints in regard to the poisoning of or the killing of cattle by manufacturing wastes, but that none of the studies of the cases has led to definite conclusions in regard to the association between the health of animals and the drinking of such polluted water.

The Wisconsin State Board of Health reports that some of the citizens of Beaver Dam complain of injury to cattle from drinking water contaminated by refuse from a gas plant.

Several boards mention that it is conceivable that cattle wading in sewage polluted streams may possibly have their udders infected with

the germs of typhoid fever and so spread the disease through milk. One board states that a large New England city, for this reason, refuses to receive milk from persons whose cows have access to a certain stream.

Herman Stabler of the United States Geological Survey mentions two interesting cases where streams pollution in Ohio led to the institution of legal proceedings. One of these cases was at Shelby, Ohio, where an acid iron waste discharged into a small stream; and the other was at Ravenna, Ohio, where the effluent from a finishing establishment crossed pasture lands. Though in at least one of these cases damages were paid, Mr. Stabler says that he does not know of a case of any kind where there seems to be conclusive evidence that injury has been done to stock by polluted waters.

It is perfectly apparent from the replies that have been received that the danger of parasitism becoming prevalent amongst domestic animals through the agency of streams pollution has not been thought of. Henry B. Ward of the University of Illinois brings out the importance of parasitism very clearly in the following letter:

"So far as the protozoan parasites are concerned, it must be said that they are almost entirely unknown, especially so far as the life-history and methods of probable infection are concerned. One is justified in saying that the intestinal parasitic protozoa, of which there are a number of very important forms, are introduced through drinking water, and that the presence of a single infected animal will pollute the stream and cause serious damage to domestic animals using the water further down. Very likely, other protozoan parasites may also be transmitted through water. The only forms which are certainly excluded are the blood-parasites transmitted by tick or insect bite.

"The trematodes, or flukes, all have an intermediate stage in snails. Infected cattle will pollute the water with the eggs of these parasites. The embryos escape readily and infect the snails. From these the next stage escapes to reinfect the same or other cattle. The parasite is naturally and widely distributed along the line of a water-course.

"Among cestodes or tapeworms, the eggs reach cattle by water or on vegetation, and stream-pollution is the means by which the parasite is disseminated. It becomes, consequently, an essential element in the maintenance of the infection. Cattle and pigs both acquire infection with the bladderworm stage through using polluted water, even though occasionally infected food brings about the same result.

"Among the nematodes, or round-worms, conditions are so varied, and, as a matter of fact, so little known, that it is difficult to make any general statement. The eggs of various whipworms, or threadworms, reach the new host, in many cases certainly through the water-supply. The well-known stomach worm of pigs, which is also a parasite of man,

is probably transmitted by contamination of food ordinarily, but may well be transported over considerable distances, and introduced into the new host through the medium of water-transport of eggs. However, it must be confessed that most of the roundworms have been so little investigated that one is compelled to speak in general terms, rather than definitely, regarding the method of protection."

To sum up this matter, it has not been thoroughly studied and it seems to offer a legitimate field of investigation to the several experiment stations. It is clear that streams pollution may inflict injury on cattle through

(1) Anthrax.
(2) Metallic poisoning.
(3) Parasitism.

Dept. of Municipal and Sanitary Dairying, University of Illinois, September, 1912.

METHODS EMPLOYED AND RESULTS OBTAINED IN IMPROVING THE MILK SUPPLY OF SPRINGFIELD, MASS.

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Read before the International Association of Dairy and Milk Inspectors, Milwaukee, October 25-26, 1912.

"The campaign for cleaner and better milk for the city of Springfield began in the summer of 1908 with the adoption of the score-card system of dairy inspection of all dairies sending milk into the city, and has been carried on in a systematic manner ever since. The problem of supplying milk to 100,000 people daily is surrounded by a great many difficulties, and, in undertaking to improve the sanitary conditions of the milk supply, the whole subject has been gone into very thoroughly so that the large financial interests involved in each part of the business should be fairly dealt with in making the desired changes demanded in the modern methods of producing, handling, storing and delivering milk."

Introduction of the Score-card at the Farm.

The introduction of the score-card at the farm requires no little tact and judgment on the part of the Dairy Inspector. For decades dealers had bought the milk from the different dairies at their own price, making no distinction between clean and unclean dairies. As long as the milk was white in color, it was saleable and all alike to them and all producers received the same price. No distinction was made as to the particular shade of white produced, and no credit was given to the naturally careful man, who prided himself on the appearance of his cows and the cleanliness of his dairy. Those naturally careful farmers received no credit or better price for their product than the more shiftless ones. The argument advanced by the clean dairyman that he took extra pains with his milk and ought to have extra compensation, had no effect as far as the price was concerned, upon the contractor. The result of this was that most of the natural high grade dairy farmers were in time forced to adopt the cheaper methods of producing milk or get out of the business. This was the state of affairs that confronted the inspector on his first visit.

Conditions Found at the Dairy.

The Dairy Inspector found the dairies would fall into three distinct classes: those having a score or rating above 70 per cent. perfect, those between 60 per cent. and 70 per cent. perfect and those rated under 60

per cent. Dairies scoring below 50 per cent. were given a chance to make alterations at once. In those cases where there appeared to be no chance of this taking place, the dairy was immediately eliminated.

The first class dairies or those scoring 70 per cent. and higher were few in number and limited to the farms of those natural dairymen who possessing sterling qualities, had the ability and enthusiasm to maintain clean places in spite of low prices received for milk. The second class dairies or those between 60 per cent. and 70 per cent. were found more often. This was especially true in dairy sections where high grade barns had been built to hold the abundance of hay and grain. With an improvement of methods these dairies would all have been found within the first class, or scoring 70 per cent. perfect or higher.

The majority of all dairies were found in the third class or those dairies scoring less than 60 per cent. perfect. The conditions existing at those dairies was the result of general farming and low prices. Cows were kept to eat hay and produce fertilizer in the barn and the herd made work for the proprietor and hired men night and morning, and rainy days.

On the first visit of the Dairy Inspector, a score card was given to each dairyman as his dairy was being scored. He also was invited to accompany the Dairy Inspector and ask questions about a number of points given each subject in scoring. This gave him an opportunity to become familiar with the working of the score card and he quickly saw its usefulness in getting at the exact standing of his dairy. In each case the Inspector pointed out the defects noted, and explained to the dairyman the effect these had on the quality of his product. He offered suggestions for the correction of these defects and gave general advice as to how the dairy and milk house could be made cleaner and do more effectual work.

At first a great deal of confusion existed in the minds of dairy men as to the practical value of this new system of dairy inspection. Gradually, however, they became acquainted with the requirements of what constituted a dairy suitable for the production of high grade market milk and the score card which at first had seemed complicated, became a source of inspiration to them. Dairymen began to realize that an improvement of their dairies and the correction of defects, as pointed out by this score card, gave them a better product.

Improvement Noted at the Dairies.

On later visits of the Dairy Inspector he noted that the first class dairymen had taken early advantage of suggestions. To them the value of high grade milk was no new thing and anything which would tend to improve their product was at once adopted. At the second class dairies, the barns began to look a little better. The cow stable had lost its neg-

lected look. Cobwebs had been swept down, floor and mangers improved and the stable given a good coat of whitewash. The manure had disappeared from the flanks of the cows and they looked more clean and healthy than at the first inspection.

The condition of many of the third class dairies showed little improvement. A few had taken time to do some fixing up, but in a majority of cases very little had been done. There seemed to be several reasons for this, as: some of those dairies were on hired farms, with the farmer struggling along the best he could under adverse conditions, not owning the farm, he was reluctant to change or in any way improve the property. In other cases, the farms had been handed down from generation to generation and the methods practiced were grandfather's and "good enough" for the present incumbent.

It was apparent to the Dairy Inspector, after visiting all the dairies sending milk into the city, that the third class dairies, if improvement were expected and the daries lifted to a position where they could produce ordinarily clean milk, frequent inspection was necessary. He readily saw that these third class dairies would demand the most attention from the Health Department. It has been found, in some cases, that by writing to the owner of the property, that the Inspector has been able to get improvements on those farms which have been leased. In many of these places, too, the situation has called forth very little work to improve them, it was simply a case of tearing down useless partitions, and letting in more light and air.

To ascertain the percentage of general improvement, fifty dairies having an average score of 53-11/100 on the first inspection were taken by the Department. These were scored again on a later inspection. The average score of the fifty dairies on this second inspection was 59–59/100 or an improvement in equipment and methods of 12–15/100 per cent. These figures illustrated to the Department, the value of the dairy score-card system of inspecting dairies and afforded definite knowledge of the efforts made by the producers in improving the sanitary conditions attendant on the production of market milk and at the same time pointed the direction in which further improvements could be made. One year later, in order to find the average percentage of general improvement in dairies as indicated by the use of the score-card, one hundred and fifty score-cards were taken in the order in which they had been visited and scored by the Dairy Inspector. Of this number of dairies twenty-four were found to have decreased in standing but the general average improvement of the hundred and fifty was a trifle over 7 per cent. Twenty-five of these dairies showed an average improvement of $24\frac{8}{10}$ per cent.; five dairies an average increase of $43\frac{7}{10}$ per cent and one dairy a gain of $55\frac{3}{10}$ per cent. To find what effect this yearly increase in the dairy score card

had on the bacterial count of the milk, twenty samples were taken from twenty ten-quart cans coming from the different dairies on August 23, 1910. On July 27, 1911, or almost one year later, with the atmospheric conditions surrounding the taking of the samples as near similar to the first as possible, twenty samples were again taken from these dairies.

The average temperature of the first samples was 62 degrees Fahrenheit and the average of bacteria per sample 577,000. On July 27, the next year, the average temperature was 46 degrees Fahrenheit and bacteria per sample 130,850. It will be noted, in the second column, that the bacteria in dairies No. 2, 3, 4, 9 and 19 are higher than in the previous year. In no cases, however, was the increase in the number of bacteria per sample as great as the decrease noted in 12, 13 and 15. This would seem to indicate that even those dairies which showed no improvement did not deteriorate enough to materially effect the general improvement of dairies sending milk into the city. Samples were taken with conditions as near alike as possible. It is seen that the average temperature of the twenty samples taken in 1910 was 62 degrees Fahrenheit and the average bacteria count 577,000 per cc. The average temperature of the samples taken the following year from the same dairies and under the same conditions was 46 degrees Fahrenheit and the average bacterial count 130,850 per cc.; a decrease in temperature of almost 26 per cent. and a decrease in bacteria of over 75 per cent. It is safe to assume from these facts that the decrease in the number of bacteria was due in part to an increase in the efficiency of equipments and methods at the dairies where the milk was produced as well as to the decrease in temperature.

Value to the Health Department.

Score cards from each dairy are kept on file at the laboratory for the information of the Department and general public. These cards give the location of each dairy, the number of cows kept and the breed, and stated whether ensilage or brewer's grain was fed, and the number of quarts produced at that dairy. It gave the name and address of the dealer to whom milk was shipped and also a complete score of the equipment of and the methods practised at the dairy.

Each dairy scoring over 50 per cent. perfect was given a permanent dairy number and the regulation made that these numbers should appear on all cans coming from that dairy. This number made possible the quick identification of milk from any dairy, and enabled the Department to trace back any complaint of contamination, disease, bitterness, ropiness, sourness, dirt or other trouble in the milk. Samples for chemical analyses are taken every thirty days from the milk from each dairy, and, in the warm summer months, bacteriological samples taken from the different

dairies as the milk is being sold upon the streets. On file, then, at the Department is the exact standing of the dairy, regarding its sanitary situation, its equipment and the methods practised; the chemical and bacteriological analyses of its milk. This information has built up a Bureau of Information for the Department and consuming public which gives the actual condition under which the milk is produced and setting forth the care it has had since that time. Any consumer by calling at the Department can find out anything they wish to know regarding the dairy from which their milk was obtained.

Those taken August 23, 1910.			Those taken July 27, 1911.		
Sample.	Temperature.	Bacteria.	Sample.	Temperature.	Bacteria.
1	64	70,000 per cc.	1	46	10,000 per cc.
2	64	320,000 " "	2	46	400,000 " "
3	64	10,000 " "	3	46	460,000 " "
4	64	20,000 " "	4	46	370,000 " "
5	64	50,000 " "	5	46	10,000 " "
6	64	460,000 " "	6	46	140,000 " "
7	64	130,000 " "	7	46	27,000 " "
8	64	110,000 " "	8	46	60,000 " "
9	64	10,000 " "	9	46	50,000 " "
10	64	400,000 " "	10	46	250,000 " "
11	64	160,000 " "	11	46	10,000 " "
12	64	2,000,000 " "	12	46	40,000 " "
13	64	6,000,000 " "	13	46	460,000 " "
14	64	40,000 " "	14	46	40,000 " "
15	64	1,200,000 " "	15	46	10,000 " "
16	56	80,000 " "	16	46	10,000 " "
17	56	330,000 " "	17	46	40,000 " "
18	56	70,000 " "	18	46	40,000 " "
19	56	20,000 " "	19	46	140,000 " "
20	56	60,000 " "	20	46	50,000 " "
Average temperature, 62 degrees F. Average Bacteria 577,000 per cc.			Average temperature, 46 degrees F. Average Bacteria, 160,850 per cc.		

Value to the Farmer.

Here for the farmer is rated the standing of his dairy, the amount of milk produced, the location and exact standing of his plant and product, so that doctors and mothers may have exact knowledge of the merit of that product, this gives the producer the benefit due his endeavors, and a chance for subsequent patronage and an advanced price for his product. Each dealer, before taking on any dairy, must first make application to

the Health Department for the taking on of said dairy. Thus the Department knows at all times who is handling milk from the different dairies. At the Department the producer may also get reliable information regarding the standing of any dealer. This system credits good, rich, pure and therefore long keeping milk to the careful, industrious dairyman to whom the credit of producing such a high grade milk belongs.

Does it Pay?

"The production of milk is purely a business proposition and it is hardly to be expected that any producer will be interested in producing clean milk unless he can obtain a fair recompense for the time involved and capital invested and it is an evident injustice to compel him to assume additional expense, labor and detail, involved in the production of clean milk and then refuse to pay him for it." To find if any relation existed between the quality and price, a canvass was made of the price paid for all milk coming into Springfield from all three classes of dairies. It was found that the average wholesale price of milk received by first class dairies was $4\frac{7}{10}$c. per quart: that the average of all the second class dairies was $4\frac{1}{5}$c. per quart, and that the average prices received at third class dairies was $3\frac{9}{10}$c. per quart.

The average price received by the third class dairies was greatly increased by those third class dairies near the market who received a correspondingly higher price because of their nearness. It will be seen that the difference between the first and second class dairies is only 22-1/2/100c per quart per day, but assuming that the dairy produces 200 quarts, the advance became 45c. per day and this amounted to $164.25 per year. An advance from the third to the first in price and standing would be $\frac{8}{10}$ of a cent a quart and for a 200 quart dairy $1.60 per day which amount to the astonishing sum of $584.00 a year. From the second to the first, would be an advance of 6/10 of a cent a quart; this in a like dairy of 200 quarts would mean $1.20 a day or $438.00 per year.

It is noted that the score card, although it may not be perfect, is the most tangible means we have of getting exact relative standing of dairies. It points out the defects and leads the improvement in the dairies themselves and their product and at least in the case of one city, has assisted the farmer to get a corresponding price for increased quality of milk.

Great credit is due Dr. E. H. Guild and the members of the Springfield Board of Health in the adoption of the score card system of dairy inspection and the formulation of regulations, which with continual efficient effort directed along right lines has made this improvement possible.

PROGRESS REPORT OF COMMITTEE ON STANDARD METHODS FOR THE EXAMINATION OF AIR.

Read before the Laboratory Section, American Public Health Association, Washington, D. C., September, 1912.

The Committee on Standard Methods for the Examination of Air made its first report three years ago recommending certain standard procedures for the determination of temperature, humidity, light, carbon dioxide and bacteria (published in the *American Journal of Public Hygiene* for May, 1910). At that time, very little work had been done from a practical sanitary standpoint on the physical and bacteriological aspects of our work, and the report was necessarily of a somewhat tentative nature. At the Havana meeting of the American Public Health Association, the committee was continued with the following membership: Dr. T. R. Crowder, Prof. M. J. Rosenau, Dr. G. A. Soper, Mr. J. Bosley Thomas, Prof. John Weinzirl, and Prof. C.-E. A. Winslow, chairman. The committee felt that a revision of certain sections of its earlier report was clearly desirable. In the time at its disposal, it has not, however, been able to arrive at final conclusions. There are still but few workers engaged in the practical study of atmospheric conditions from the sanitary standpoint, and the chemistry and bacteriology of air are far less developed than the chemistry and bacteriology of water and milk.

Before a definite and final report worthy of the confidence which the name of the committee and the association imply, can be made, much more research will be required. Methods will have to be tested, compared and, in some cases, actually devised. Two or three years of time should be given to the committee for this work and the committee respectfully asks for this time. By the end of such a time the committee believes it will be able to announce a set of definite procedures which can confidently be recommended as worthy of adoption as standard.

Meanwhile, however, the committee submits the following interim report showing the present progress and tendency of its work. It is hoped that such suggestions may be of some assistance to the workers in this field during the coming year and that they may bring from such workers the suggestions and advice which the committee needs for the completion of its work. The present report is, however, in no sense to be taken as a final and definite one.

Determinations to be Made in the Examination of Air.

The original conclusion of the committee, that the determinations of temperature, humidity, dust and intensity of light provide the most

important data to be secured in a sanitary study of atmospheric conditions, while tests for carbon dioxide and bacteria are useful for special purposes, seems to have been amply confirmed by subsequent experience. The committee believes, however, that the time has come for the inclusion of chemical tests for certain specific poisonous substances, like carbon monoxide, wood alcohol, arsenic and the like, which are discharged into the air by the combustion of fuels and in the course of industrial processes and which have an important bearing on the public health.

Temperature and Humidity.

The standard methods recommended in 1909 for the measurement of temperature and humidity—the recording thermometer and the U. S. Weather Bureau Sling Psychrometer—appear on the whole to have proved quite satisfactory, and the committee believes that no essential change in either is desirable. The swinging joint of the sling psychrometers on the market gives a little trouble in practice and some observers have complained of serious breakage of the instruments in the hands of their inspectors. General experience, however, seems to indicate that with a little training inspectors learn to use the sling psychrometer without serious difficulties.

Dust.

The committee in its 1909 report recommended two procedures for determination of the number of dust particles present in the air,—the use of the koniscope and the sugar filtration and microscopic counting method.

The committee hopes to study the koniscope further during the coming year, but is at present inclined to the view that this instrument is much less suitable for general sanitary purposes than is the filtration method. The standardization of the koniscope offers serious difficulties since it depends upon the recognition by the eye of the depth of color produced by fog in a vacuum tube. More serious, however, is the fact that the koniscope reveals all the minute ultra-microscopic particles in the atmosphere and thus masks the differences in the number of fairly large particles (such as industrial dusts) in which the sanitarian is interested. For example, in a recent study of the air of New York streets and schools by the filtration method, it was found that the number of dust particles generally varied between 400,000 and 1,000,000 per cubic foot. Macfadyen and Lunt (*Transactions of the British Institute of Preventive Medicine*, I, 142), on the other hand, found about 9,000,000,000 dust particles per cubic foot in ordinary indoor air by the use of the dust counter, which works on the same general principle as the koniscope but is the more exact instrument. The dust counter determines exactly, and the koniscope

determines approximately the number of particles down to a very high degree of fineness of the particles. What is needed for sanitary purposes is a reasonably accurate determination of the comparatively few, but rather large, particles which lacerate the epithelial tissues and favor the development of disease.

The filtration method gives this latter information, accurately measuring the number of particles large enough to be seen under a $\frac{2}{3}$ inch objective. As tested out by members of the committee it has proved on the whole satisfactory. The worst feature of it is the slowness of the sampling process due to the necessity of forcing a large amount of air through the small sugar filter. This difficulty has been mitigated to a considerable extent by the following changes: Instead of using a small glass tube, as recommended in the 1909 report, the committee in its recent studies has used a chemical adapter (a conical piece of glassware seven inches long having openings of $\frac{5}{8}$ inches at the smaller end and $1\frac{1}{2}$ inches at the larger end). The small end is closed with a perforated rubber stopper over which is placed a piece of bolting cloth to support the filtering layer made up of about 2.5 grams of granulated sugar, forming a layer 1 cm. deep. This modification of the older sugar filter was devised in the course of an investigation of the air of New York schools carried out by Prof. Charles Baskerville and the chairman of this committee. Five cubic feet of air can be drawn through this filter in eighteen minutes. The sugar is dissolved and the contained dust suspended in 10 cc. of distilled water and 1 cc. of the suspension is placed in a Sedgwick-Rafter counting cell and counted under the $\frac{2}{3}$-inch objective.

Another method of determining dust particles which is still quicker and simpler, has been used by Dr. C. T. Graham-Rogers of the New York State Department of Labor and was described by him in a paper read before the International Congress of Applied Chemistry in New York. He uses a glass cylinder 8 cm. in diameter and 20 cm. long with the top and bottom closed by perforated round glass stoppers. About midway in the cylinder is suspended a Petri dish of such a size as almost, but not quite, to fill the cylinder. The Petri dish is ruled in squares and smeared with glycerine. The air to be examined is drawn downward through the cylinder, so that it strikes the surface of the glycerinated plate and deposits its dust particles before finding its way around its edges, and the particles so deposited are counted directly under the microscope by the aid of the rulings on the plate. The committee hopes to make a study of this procedure in comparison with the sugar filter method during the coming year.

For collecting samples for dust determination, the following apparatus was found serviceable in the study of New York schoolroom air, to which reference has been made above. The air was drawn through the filter by means of a double suction pump (Eimer and Amend No. 750) which is

like a bicycle pump except that it has a double acting valve. To compensate for the puff of back pressure at the end of a stroke, a tight tin box was placed between the pump and the filter as an equalizing chamber. On the other (or pressure) side of the pump was connected a standard Brazilian type gas meter for measuring the amount of air filtered.

Illumination.

The committee believes that careful study should be given to the Sharpe-Millar photometer and other recognized methods of measuring the intensity of illumination in the hope of finding a procedure which will be superior to the use of sensitized paper recommended in 1909 and which will still involve the use of neither very costly nor cumbrous apparatus.

Carbon Dioxide.

In the 1909 report the Petterson-Sondén and Petterson-Palmquist methods were recommended for accurate work, but on account of the cost and complexity of the apparatus the Cohen and Appleyard time method was recommended for practical sanitary work. Evidence has accumulated, however, which indicates the unreliability of the latter procedure; and meanwhile the apparatus required for the Petterson method has been simplified and cheapened. There are at least two forms now on the market which are reasonably satisfactory and one or the other of them may probably be adopted as standard after further study. The general principle of all these methods is the measurement of a given volume of air and the absorption of the contained carbon dioxide in potassium hydroxide. The remainder of the air is measured, thus giving the volume of carbon dioxide by difference. The air is measured accurately by means of readings on a very finely graduated capillary tube, and all measurements are, of course, made at the same temperature and pressure. The principle is simple but dependable results are obtained only after considerable practice and a thorough mastery of the technique of operation.

A modified form of the Petterson-Palmquist apparatus has recently been prepared in this country by Eimer and Amend of New York, which can be obtained for about fifty-five dollars. It has the advantage of a considerably reduced bulk, and it is portable when fitted with an outer casing. Samples of air can be analyzed with this apparatus in about five minutes by a careful and skillful operator. It has been tested extensively by one member of the committee (Doctor Crowder) and by Doctor Graham-Rogers, and has been found eminently satisfactory.

The other apparatus which seems most promising is the portable apparatus designed by Haldane for the determination of CO_2 O_2 and CH_4 described in the *Journal of Hygiene*, for 1906, p. 74. This apparatus can

be obtained from F. P. Rittenhaus & Co., 53A Huntly Street, Tottenham Court Road, London, W. C., at a price of $20 and requires about three months to import. Eimer and Amend can make the same apparatus for $35 in about two weeks. Rittenhaus, according to Haldane, also makes a much smaller apparatus for CO_2 only, for $15 (described in Notter and Firth's *Hygiene*). The larger Haldane apparatus has been carefully tested by one member of the committee (Doctor Rosenau) and found to be simple and accurate. It should be noted that the Haldane apparatus is made up in two forms, one for use in mines and one for ordinary use. The mine apparatus is not sensitive enough for use in ordinary ventilation studies.

For the Petterson-Palmquist or the Haldane methods of analysis the samples are collected in two-ounce, glass stoppered bottles of clear glass if the analysis is not made with the portable apparatus on the spot. These bottles hold about 70 cc., which is enough air to make two analyses, in case it should be necessary—and it is always advisable—to repeat determinations. The stopper of each bottle is greased with petrolatum, or with a mixture of petrolatum and soft paraffine which will spread readily under pressure; and after the sample is taken, the stopper should be turned round and pressed down until no air channels are visible in the petrolatum. The stopper is held in position by a stout elastic band passed over it, and a gummed label is placed on the bottle.

The bottles *must* be dry, and they should also be clean. They should be rinsed with clean (preferably distilled) water and completely dried. If a bottle is wet and dirty an appreciable amount of CO_2 may be produced or some may disappear by bacterial action. If, on the other hand, the bottle is wet and clean, carbonic acid gradually disappears, as it is absorbed by alkali dissolved out of the glass by the water. In *dry* bottles, even though dusty inside, no sensible alteration takes place within a fortnight or more.

The sample may be collected as follows: One end of a piece of rubber tubing, two or three feet long and one-eighth or one quarter of an inch in diameter, is introduced to the bottom of the bottle, the other end being held in the mouth. A deep breath is then sucked in through the tube, so that the bottle is completely washed out by the surrounding air. The tube is removed while the air is being still sucked in, so as to avoid any risk of the breath passing backward into the bottle. The stopper is then inserted, turned around, and secured as already described, and particulars written on the label. Care must, of course, be taken that the sample be not contaminated in any way by the presence of persons or lamps. If it is desired to take samples at some distance from the operator, the plan may be varied by fitting the breathing tubes by a glass connection to one of the holes in a double bored rubber stopper which will just fit

the bottle. Into the other hole, and ending just below the stopper, should be fitted another tube through which the air enters. If this second tube has great length, several breaths should be sucked through in succession, in order to entirely displace the air originally contained in the tube.

Samples may be first collected in large rubber bulbs, such as are used with the Paquelin cautery or the sphygmomometer, and then transferred by passing the outlet tube to the bottom of the bottle. If the bulb holds 800 or 1000 cc. there need be no fear about completely displacing the original air of the bottle. This method has the advantage that one sample of the air may be collected from many points in a room, and will in consequence be an average sample.

The water siphon method, the steam vacuum method, and others discussed in our earlier report have the disadvantage of a wet container. This may not matter if the analysis is to follow immediately upon the collection, but it is not recommended where any considerable interval is to elapse.

When larger containers than can be manipulated readily by breathing are to be used, some sort of a small hand bellows or suction pump is recommended for displacing the air in the container.

Care must be taken in transferring the air sample to the apparatus, that there is no contamination. A method which has proven very satisfactory and is free from sensible error in the use of the Petterson-Palmquist method of analysis is as follows:

Remove the stopper of the bottle containing the sample to be analyzed under a saturated solution of pure sodium chloride. A little air will escape or a little of the solution will enter and by this the pressure in the bottle will be equalized to that without. Lift the bottle until the fluid in the neck is level with the surface of that in the basin. Slip a finger over the mouth of the bottle and transfer to any convenient stand near the mouth of the pipette. Slip the finger off sideways and immediately insert a double-bored rubber stopper which will fit snugly. This stopper should be previously made ready for use by inserting two small glass tubes through its bores, one of which will reach well toward the bottom of the bottle, and one of which ends just below the stopper. To the longer glass tube is attached a rubber tube which acts as a siphon leading from a large bottle of saturated sodium chloride solution placed at a higher level. This siphon is kept always full of the solution which is held back by a pinch-cock. To the shorter glass tube is attached a very narrow rubber tube (a small catheter with a conical tip answers best) which will reach to the mouth of the apparatus. As soon as the stopper is in place, press the pinch-cock and thus allow the salt solution to run into the bottle. This causes some of the sample of air to flow out through the small tube. When all of the air originally contained in the tube has been displaced, the free

end is attached to the pipette and the air let in, being forced out of the bottle by the flowing salt solution.

After equalizing the pressure in the bottle by the process described there is no sensible interchange of gases during the moment of removing the finger and inserting the rubber stopper.

Detection of Poisonous Gases.

It would be desirable in the future to formulate standard methods for the estimation of a number of gases and noxious vapors which may be found in the air of factories and other industrial establishments, and for the carbon and tar represented in soot, and the sulphuric acid which exerts important effects in city air. The committee has been unable to go into this aspect of the work as yet, but desires to call attention to two methods used by Doctor Graham-Rogers in the work of the New York State Department of Labor as deserving of special study.

In one method used by Dr. Graham-Rogers for the determination of carbon monoxide air is drawn through U tubes containing caustic potash, sulphuric acid and anhydrous iodic acid along with three to four times the amount of large pieces of pumice stone. Heating in an oil bath at 150 degrees converts the carbon monoxide to carbon dioxide and liberates iodine which is titrated with $\frac{1}{1000}$ normal sodium thiosulphate. When 3-4 liters of air are used, one part in 40,000 parts of air can be detected.

For the determination of wood alcohol, Doctor Graham-Rogers aspirates 250–500 liters of air through wash bottles containing distilled water. A fractional part is allowed to stand half an hour with 4–5 grams of potassium dichromate and 3–4 cc. of concentrated sulphuric acid. The formic acid produced may be estimated by acidimetry or saturated with barium sulphate and precipitated as barium formate.

Bacterial Count.

The most important new method suggested for enumerating the bacteria in air since our 1909 report is that described by Rettger in the *Journal of Medical Research* for June, 1910, in which air is bubbled through water by the use of a glass bulb with very small perforations. This procedure seemed promising and has been carefully studied and compared with the sand filter method by members of the committee (Professor Weinzirl and Mr. Thomas).

In setting up the apparatus each used the sand filter as described in the standard methods, but it soon appeared that some modification was necessary. It was evident that the large opening of the sand filter tube might receive, by the direct settling of dust, a greater number of bacteria than the smaller opening of the aëroscope. Mr. Thomas met the diffi-

culty by protecting the opening with an aluminum shield, while Mr. Weinzirl reduced the size of the opening by inserting a stopper fitted with a glass tube of the same diameter as the aëroscope tube and bent in a similar manner. The aëroscope also differed slightly; Mr. Thomas omitted the bulb, but closed the end of the tube, filed notches nearly through the walls, and made the holes in these notches with a very sharply pointed file, while Mr. Weinzirl duplicated Rettger's apparatus. It is believed that this difference is not essential.

In the trials the filter openings were as near together as possible, the distance being usually an inch or less. The bacteria were supplied by beating cloths which had been rubbed over the laboratory floors and steps. Eight-liter, graduated bottles were used as aspirators, the rates of filtration being equalized by means of screw clamps applied to the siphons. It was difficult to maintain exactly uniform rates of filtration, but care was taken to obtain as nearly uniform rates as possible before the air was charged with dust.

Under the conditions as outlined above, the results obtained agreed fairly well, although Weinzirl secured almost an equal number of excesses for both methods, while Thomas secured excesses only by the sand filter method. As the excesses (particularly those obtained by Weinzirl) are not large, and as the second tubes show only small numbers of bacteria, the two methods compare favorably so far as accuracy is concerned.

The question then resolves itself largely into one of the comparative convenience of the two methods. While it is somewhat easier to make plates from the water filter, we find the sand filters in every way easier to operate. The aëroscopes are more difficult to make, or more expensive if purchased; they are more easily broken; and when being handled they frequently get out of order. Again, sand filters, if protected, may be used some time after being sterilized, while the aëroscopes tend to lose water by evaporation during sterilization and storage, thus vitiating the accuracy of the work. In actual sanitary work, when many samples are to be taken, and at a distance from the laboratory, we believe that the aëroscopes would give more trouble than the sand filters. Although no work has been done to confirm the belief, it seems not improbable that under certain conditions the absorption of sulphur dioxide or other gases in the five cc. from ten to twenty liters of air might have a restraining action upon the growth of some of the organisms absorbed.

The corks used in the sand filters are soon ruined by the heat, and unless great care be exercised, they are liable to leak. It was found that rubber stoppers may be substituted if the tubes are sterilized in the autoclave. We would recommend their use.

It was obvious, as mentioned above, that the large opening of the tubes permits gross particles to enter by force of gravity. We would, there-

fore, recommend that the mouth be closed by an additional stopper fitted with a very short glass tube bent at an angle of about 45 degrees.

In the comparative tests the absorption efficiency of the tubes was probably more severely taxed than it would be in actual practice. In our judgment, the use of the second tube affords but little additional advantage, while it does render the method cumbersome, and the slight additional accuracy does not justify the extra labor involved. We would, therefore, recommend the use of single tubes only. Otherwise the method recommended in 1909 seems on the whole satisfactory.

Respectfully submitted,

T. R. Cowder.
M. J. Rosenau.
J. Bosley Thomas.
John Weinzirl.
C.-E. A. Winslow, *Chairman.*

Doctor Soper's Reasons for Declining to Sign the Report of the Committee on Standard Methods of Air Analysis.

1. I object both to the form and substance of the majority report.

2. I have not been given a chance either to test the new methods referred to or give them the careful thought which they should receive from each member of the committee before being reported upon.

3. In many respects the majority report is open to severe criticism such, for example, as was properly made against the first report of this committee.

4. The theory of the report is wrong. The committee should not report methods which merely seem worthy of study, but should do the studying required and announce the results in plain and concise language.

5. In the absence of the sound and sufficient knowledge which should lie at the bottom of the report, the committee should be brief and conservative.

George A. Soper.

BOOK REVIEWS.

House Sanitation, a Manual for Housekeepers. *By Marion Talbot.* (*Whitcomb & Marrous, Boston, Mass., 109 pages, price 75c.*)

This little book has been written to take the place of Mrs. Ellen H. Richard's book on Home Sanitation, which was published some twenty-five years ago and is now out of date. The present book, while entirely rewritten, contains all the useful matter of the older text and also the results of later experience and research in sanitary science, thus bringing it up to date. As the author says in her introduction, it is an endeavor to replace outworn theories and useless practices with such modern views and practical suggestions as will best help the professional housekeeper in her effort to maintain her household in health and physical efficiency with the least expenditure of money, time, and strength. Some pages are given to a discussion of the new sanitation, showing how modern scientific research and the practice of hygiene has changed the early Christian beliefs that disease was caused by the wrath of God or the malice of Satan into a knowledge that health depends largely upon freedom from infection and good sanitary surroundings. The reader is shown why the housekeeper is responsible for the sanitary condition of her home, and a detailed account is given as to what the housewife should know in order to keep the inmates of her home in health. The dangerous qualities of an unsanitary house are pointed out and attention is called to the fact that women who are so often confined to the house by their work suffer most from unhygienic surroundings which slowly and insidiously undermine their health, producing Languor and preventing sustained effort. The importance of selecting a healthful site for the home is emphasized and it is shown that while defective construction may generally be remedied, unhealthy surroundings, an undesirable aspect, or insalubrious building site cannot be changed. The chief essentials to be secured are pure air, sunshine and dryness, as these are conditions upon which physical and mental vigor largely depend and without them the human system loses its power of resistance to disease. A very good description of the plumbing system as installed in modern houses is given, together with suggestions for keeping it in condition. Air, ventilation and furnaces, light and lighting, together with practical suggestions in regard to furnishing are all touched upon. There are also special chapters on country houses and the methods used to control infection when a contagious disease attacks a member of the family. At the end of each chapter all the important points are summed up in the form of questions, which add greatly to the interest of the book and draw attention to the essential features.

Thomas S. Carrington.

Recherches sur L'epuration biologique et chemique des Eaux d'egout. *Calmette, A., Rolants, E., et als. Vol. VII, Paris, Masson, 1912, 360 pp. 2 plates, 20 figs, and 14 cuts. Price 10 fr.*

As in former years, this volume contains eighteen chapters in which the authors have not only described their own work but that of French and foreign scientists upon all points in that so complex a problem, the disposal of sewage and factory wastes.

The experimental station at La Madeleine, near Lille, has not been altered during the year. It was operated to study the results obtained during the previous year and to confirm the same.

The Septic tanks at La Madeleine have removed most of the suspended matter from the sewage and have caused the solution and gasification of an important part of the organic matter. At the same time it was

noticed that on one or two occasions during the year the tanks were not cleaned frequently enough; in June considerable suspended matter was entrained with the effluent. The tanks should be cleaned every six months, at least.

The mixture of slag and pumice stone has proved to be the best filling material for the biological filters, also slag alone, peat and pumice stone and bricks with peat and limestone can be used advantageously. When slag is used alone, there is need, as the authors have already noted, to select hard, durable material, because the weather and the alternate wetting and drying disintegrates it to such a degree that what might be called an automatic silting away takes place. This tends to increase the voids whereby a part of the sewage escapes purification.

Beds of broken brick and pumice have always produced unsatisfactory results. They should be used for large beds in cases of necessity only.

While the sewage of La Madeleine is low in organic matter and its strength is below the average for sewage from the combined system of sewers, it is purified with difficulty because of the presence of a considerable amount of industrial waste. Also the efficiency of filtration falls very rapidly when the volume of sewage treated exceeds 500 liters per square meter a day. These experiments are being continued to determine, by detailed study, the influence of the material upon the result of purification, the same to be dependent in a way upon the relative costs of these materials.

After the disposal plant for the part of Lille in which the Abattoir was located was put in operation it was possible to investigate the feasibility of purifying abattoir wastes by biological methods, a matter considered very difficult hitherto. It was feared that the bacterial beds would not produce well oxidized and non-putrescible effluents,—the sought-for result. On the contrary, the analyses of the final effluent and those of samples taken at all stages of the process have shown that, at a rate of 600,000 gallons per A. per 24 hours, applied in 14 hours, the results have not ceased to be excellent and it is believed that the rate can be increased to one million gallons per A.

Nitrification has always been very active. The amount of nitrates in the effluent has averaged 76 Mg. per L. with a maximum of 134 Mg. The Kremer tank (Emscher type) removed 57.6 per cent of the suspended matter, a very good result when the composition and density of the abattoir waste are taken into account. In the sludge chamber the organic matter, soluble and insoluble, has been digested in great part.

The waste offers an interesting opportunity for the study of colloidal matter. Analyses have shown that this matter is precipitated in each part of the process, particularly in the Kremer tank and most completely by septic decomposition and by accumulation on the particles composing the filter material. The oxidation of the latter deposit is not complete and a portion sloughs off and is removed from the effluent, before discharge into the river, by decantation.

Of the factory wastes, that from wool scouring plants causes the most nuisance when discharged into streams. The authors have not studied the problem for long. They note the large amounts of organic and mineral matters as well as grease and the extremely slow decomposition of all by physical, chemical or biological agencies. But their purification is necessary. The authors hoped to secure the coöperation of manufacturers but were disappointed. No complete factory disposal works exist in France, although some plants have been forced to remove more or less grease from their wastes.

Study of French and foreign works has brought the authors to the following conclusions:—

The diversity of methods employed exemplifies the difficulty of the problem.

In small factories, the volume of waste being small, chemical precipitation is sufficient, but the effluent would be discharged into a sewer or large river. One can recover grease from the sludge but the effluent ought to be retreated with lime and iron sulphate to remove the impurities. In other cases

simple precipitation with lime is used; the dried sludge can be treated subsequently.

The larger works are usually surrounded by the houses of the numerous workers. Of two at Robaix, one discharges 435,000 and another 1,111,000 gallons daily. Generally it is difficult to install an effective plant in the usually restricted space, although the expensive process of evaporation, most desirable from a sanitary standpoint, is adapted to close quarters.

For the present the authors recommend chemical precipitation of the wool-scouring waste and its mixture with the city sewage as the most practical and economical process. The purification of the mixed sewage and waste should be relatively simple. If possible, the disposal of wool-scouring waste by precipitation ought to be conducted at a central coöperative station, directed by a competent engineer. The effluent from the precipitation tanks should be clear and neutral before discharge into the sewers.

Chemical precipitation will effect a great betterment of the streams and put an end to the justifiable complaints by Belgium against l'Espierre and the riparian proprietors of Vesdre and l'Ourthe.

In other chapters the authors report upon French and foreign methods for purifying wastes from oil refineries, creameries, mines, paper mills, sugar refineries, etc. Studies in England and America show the nuisance produced by discharging sewage directly into tide water and the need for improvement of conditions. The questions of removal of suspended matter and sludge treatment are of capital importance; also it is interesting to note the many new processes proposed. The part played by the Septic tank is discussed at length and the conclusions of Dzersgowski are refuted in Chapter XI which also contains a description of a new biolytic tank.

Finally the last chapter takes up the control of purification. A comparison of the oxidizable matter in with the reductive power of the treated sewage should be an index of its stability. Bacterial examinations are useful in special and relatively rare cases only.

Review based on review in French in Wasser und Abwasser, *5*, 273, by E. Rolants, one of the authors.

R. S. Weston.

Principles of Hygiene. *By D. H. Bergey, M.D., First Assistant, Laboratory of Hygiene and Assistant Professor of Bacteriology, University of Pennsylvania. Fourth edition thoroughly revised. Octavo of 529 pages, illustrated. Philadelphia and London: W. B. Saunders Company, 1912. Cloth, $3.00 net.*

The present revision of Doctor Bergey's well-known treatise has been undertaken to keep it in pace with the rapid advancement of hygiene and public health. The book is prepared primarily to meet the needs of students, practicing physicians and health officers. Its object is to treat general principles with no attempt at an exhaustive treatment of detail.

The introduction places before the student a logical statement of the factors of health and disease and of the aims of hygiene and of sanitary science. These various terms are carefully defined and the influence upon health and disease of such factors as age, sex, heredity, race, conjugal condition and environment are discussed with statistical illustration.

The first chapter deals with the air. Its physical and chemical properties, and the effect of humidity, currents and climate are treated. The chapter deals in the main with impurities, with their analytical determination, and finally with the effects of vitiated air. The author appears to accept the modern views that excessive temperature and humidity are the principal hygienic factors involved, but is loath to give up the older thought of vitiated air *per se*, as a predisposing cause of various ailments, ranging from headache to specific zymotic diseases.

Upon the basis of a carbon dioxide standard, the cubic space which must be provided for each individual and the necessary amount of artificial ventilation are formulated.

Treatment of the subject of ventilation itself is modern and satisfactory, and supplies many physical data, useful in computing the efficiency of various mechanisms.

A chapter on heat opens with a discussion of the loss of heat from buildings, and the proper hygienic temperature of rooms. Direct and indirect methods of heating, the loss of radiation and the principles of hot water and steam heating are taken up. The chapter naturally deals in a most elementary way with a very large problem.

Chapter IV deals with water and water supply. The physical and chemical properties of water itself, and of various types of natural waters are discussed in some detail. One is left in considerable doubt as to the significance of the various chemical impurities that are discussed. Organic impurities are said to be of importance as indicators of the nature and extent of pollution, but all waters contain these substances. Possibly this uncertainty is a true reflection of the present state of the art, but the student would be better prepared to meet the conditions of practical public health work, were he further told that there is today a considerable body of scientists who hold that there is but little information to be had from the chemical analysis of water. It is unfortunate also that the quantitative element is omitted in the discussion of water bacteriology. Sources of water supply, the storage and purification of water and the improved health conditions following improvement in the water supply are briefly outlined. In the sections on coagulation by alum, on the softening of hard waters and on chemical sterilization, lack of familiarity with the subject is suggested. The statement (p.133) that the action of alum in the precipitation of suspended matters is most marked if calcium carbonate is present, might lead one to treat soft waters with alum. The relationship between alkalinity and the permissible dose of alum, should be pointed out.

The treatment of water softening would lead to the belief that softening related only to carbonate hardness. The statement that chlorine as hypochlorite may be added to the water in amounts ranging from 2 to 10 milligrams of free chlorine per liter of water, is undoubtedly a misprint. These amounts are ten times too high.

It is to be regretted that the revised edition of the report of the Committee of the American Public Health Association on Standard Methods of Water Analysis, issued during the past summer, was not used in place of the older superseded edition, from which extensive quotations are made.

The chapter on Sewage Disposal is unfortunate, both in the selection and in the arrangement of its material. It starts with the erroneous conception that sewage is synonymous with excreta, whereas the term sewage as used in engineering means that liquid which flows in sewers. Mr. Mills' old expression that sewage contains 998 parts of water, 1 part of organic and 1 part of mineral matter, a statement of very questionable applicability to present-day conditions, is misquoted to read,—"998 parts of water, 1 part urine, and 1 part of organic matter." Systems of house drainage are described with a curious mixture of detail and generalizations and much faulty material. The remainder of the chapter on purification comprises isolated bits of information gathered from various sources, and put together without much order. Chemical treatment, now practically out of date, is given first and most prominent treatment, although the most modern chemical process, disinfection, is not described.

Under the title of Modern Methods of Sewage Purification, the work of the Rivers Pollution Commission of 1870 and of some irrigation plants is described. Then follows a description of sand filtration, with a table of results from a non-described source, obviously referring to a trickling filter. Under this heading also an example is given of plain sedimentation and the discharge of the effluent into the stream. The septic tank is given more lengthy treatment than any other sub-division, and is followed by a short discussion of the contact bed, and a more extended one of the Garfield Coal Filter. A four page summary of disposal plants in America is quoted from the *Engineering Record* of 1900. Under sprinkling filters the generalization that sewage may

be applied at the rate of two million gallons per acre per day, and that the effluent obtained will be non-putrescible, and contain about 10 per cent. of the applied bacteria is made without quoted authority. In the report of the Philadelphia experiments a rate of two hundred and fifty million gallons is said to be possible. The chapter on Sewage Disposal needs thorough revision.

The chapter on Garbage, which follows, is more successful, although exceedingly brief. Something is evidently wrong with the statement on page 181, that garbage is composed of 20 per cent. carbon and 80 per cent. water. The Ordinances of Philadelphia are quoted and a brief summary of the various methods of disposal is given.

In the chapter on Food and Dietary, the author is once more upon familiar ground. He describes the chemical composition of the body, the potential energy of foods expressed in heat units, the derivable energy, dietaries, nutritive value and cost composition, and the question of water at meals. Foods are treated with respect to their chemical composition, percentage of waste, and food values. The author takes a definite stand upon the question of the use of slightly tubercular animals, favoring the absolute prohibition of such use. Not only is there danger of infection by the butcher's knife, of the healthy portions from the diseased portions, but perfectly healthy carcasses may be similarly infected. Milk and its products are treated with reference to their composition and the possibilities of their conveying disease. Inspection of the animals and tuberculin testing is recommended. The New York City Ordinance of 1895 referring to transportation and delivery of milk, and other ordinances of the same period up to the Fifty Dairy Rules of the Bureau of Animal Industry of 1898 are quoted. It is unfortunate that in a subject in which such rapid progress has been made during recent years, the information given is not of more recent date. The question of pasteurization is not touched upon, although now required in the largest cities.

Chapter VIII deals with Exercise. It is brief, but fairly comprehensive. Chapter IX takes up Clothing and Chapter X, Personal Hygiene. The latter occupying four pages, might well have been extended at the expense of some of the more purely engineering features of the book. The chapter on Industrial Hygiene is a compilation of statistical material on this subject. It too is brief for a work of this character, and is lacking in references to the more important work of recent date.

The chapter on School Hygiene is a summary of rather self-evident facts, such as the statement that windows should never be in the front of the room, the blackboards should be opposite the windows, the heating may be either by direct or indirect methods, the building should have an abundant supply of pure water, etc. Such statements should at least be supplemented by such topics as, common use of slates and pencils, the common drinking cup and towel, the schoolhouse problem during epidemics, the disinfection of books, etc.

The chapters on Military and Naval Hygiene contain material of interest to specialists in those lines. Chapter XV deals with the soil, including ground air and ground water. The following chapter deals with Habitations.

Chapter XVII deals with the Vital Causes of Disease. It opens with a chronologic list of the various specific pathogens down to the year 1906. An extended discussion of immunity and of the various sera, including typhoid serum follows. Sections on other methods of prevention, especially of malaria and yellow fever and of the relation of insects and other animals to disease transmission are followed by a discussion of the animal parasites with specific references to the hook worm.

Chapter XVIII deals with Disinfection. Heat and sunlight are first treated. The chapter is exceedingly practical, illustrating many types of formaldehyde generator, and giving formulas for the use of many preparations. The author is emphatically in favor of the most thorough disinfection of the house after infectious disease. He also treats the question of the disinfection of public conveyances, of libraries and of barber shops and implements.

The following chapter treats of Quaran-

tine. The older work of the Michigan Board of Health down to 1896 is used to illustrate its value. No hint of the more recent views of Chapin and others is given. The Quarantine Laws of the United States are quoted at length, and abstracts are given from those of the various states.

The book closes with a chapter on Vital Statistics. The various standard terms used in the discussion of this subject are briefly defined, although one must seek elsewhere for a confirmation of the mathematical quantities given. The chapter is unfortunately brief for so important a topic of modern public health work.

The work on the whole is of a type which will of necessity become less and less useful with the rapid accumulation of knowledge in this subject. The subject of Hygiene in all its varied aspects may at the present moment be divided into Hygiene proper, the Medical and Personal side, and Public Hygiene or Sanitation, the Engineering and Administrative side. The latter is capable of futher sub-division into a large number of important matters, each of which now has its own literature. A work which undertakes within the covers of one volume to encompass the entire field, must of necessity be not only superficial but in many of its parts out of date, if not actually misleading. As a guide to the general scheme of the broad science of Hygiene to be supplemented by more extensive reading in the recent literature in special branches, this work is to be recommended.

Earle B. Phelps.
Mass. Inst. Tech.

A Manual of Personal Hygiene. *By American Authors. Edited by Walter L. Pyle. Fifth Edition. The W. B. Saunders Company. Philadelphia and London,* 1912. *pp.* 516. Net, $1.50

About two years ago the fourth edition of this work received favorable notice in this Journal. In its present form Pyle's "Personal Hygiene" will be even more secure in its place as the best manual of moderate size covering an important field. The contributors are specialists of wide reputation. In any edited work one expects inequalities of style and questionable apportioning of space to various topics. In these respects each edition of this book has shown improvement over the preceding. There is now little included which could be spared and it is hard to suggest any important omissions.

Doctor Courtney's chapter on the "Hygiene of the Nervous System" retains its rank as the most readable and broadly helpful in the book. A section introduced for the first time is Dr. Wiley's on the "Adulteration and Deterioration of Foods." The subject is a rather unwieldy one for condensed treatment, but its inclusion is certainly desirable. It may be suggested that the general reader needs to be told more specifically which adulterations are clearly detrimental to health and which are merely fraudulent.

Percy G. Stiles.

PUBLIC HEALTH NOTES.

Co-operations from the Schools.

The November *Bulletin of the Health Department*, of the city of Asheville, N. C., contains a copy of a letter recently sent out by Professor Tighe, superintendent of City Schools, to all the teachers so that everything may be done to prevent the spread of communicable disease in the schools and to maintain the schools in a thoroughly sanitary condition:—

"To Principals:—It is necessary now to take every precaution to keep contagious and infectious diseases out of your building. So far diphtheria cases have appeared in but two schools, but unless we are very careful it will scatter to others. Please observe the following:

"1. Have janitors spray all desks and floors with disinfectant daily before sweeping.

"2. Have all door knobs and stair rails sprayed or washed three times daily. Tell children not to use stair rails.

"3. Do not permit children to exchange pencils, books, pens, or other supplies.

"4. Let each child keep his own seat. Do not permit them to sit with others.

"5. Do not permit them to hold hands in marching.

"6. Have teachers to watch carefully for sore throats and other signs for sickness each morning as children arrive in school and send suspicious cases to you to be sent home if necessary. It will be safer to send them home if there is any sign of sore throat or fever.

"7. See that your building is carefully swept and dusted daily by the janitor. There should be no dust in evidence in the mornings.

"8. Have halls sprayed and swept after nine a. m., after the morning recess. In marching in and out, let there be no stamping or raising of dust.

"9. Call your teachers together and begin a campaign now for greater care and greater cleanliness among the pupils and in the rooms. Do this all without making a scare among the children, teachers or parents.

"10. The children should be encouraged to keep their mouths clean by brushing teeth and by gargling with salt water if nothing else. This work can be taken up in Hygiene lessons telling the children the necessity for such things.

"See that the janitors make the disinfectant sprays the proper strength according to directions on the receptacles."

Diphtheria Prevention.

The November (1912) *Health Department Bulletin* of Asheville, N. C., after stating that "no death is more inexcusable with our present knowledge of the disease and sure means of prevention and cure which we now possess than a death due to diphtheria," lays down for laymen the following practical rules:—

"1. Keep your children away from every case of sore throat.

"2. Report to the Department of Health every case of sore throat in your neighborhood that is not placarded.

"3. If a case of sore throat occurs in your family, call the doctor at once.

"4. Don't try home remedies, and don't wait for white patches in the throat. The worst cases begin in the nose and deep in the windpipe and show no patches.

"5. If it is at all suspicious, antitoxin, and plenty of it, should be used at once. In doubtful cases it is best not to wait for a positive diagnosis; use antitoxin.

"6. If you are too poor to pay for antitoxin, the state, through the county health officer will supply it without cost.

"7. If a case of diphtheria is diagnosed in your family, have all the other children given antitoxin to prevent them from taking the disease."

The Children's Bureau.

The number of the *American Journal of Sociology* appearing in November (1912) publishes an address on "The Children's Bureau" by Miss Julia C. Lathrop, Chief of the Bureau. Miss Lathrop reviews the his-

tory of the events leading up to the creation of the Bureau and gives credit to the various organizations influential in its establishment. The aim of the Bureau is to be a vital, coöperative force, serving the needs of the whole country, arousing a sense of personal responsibility, and stimulating the functions of states and cities and counties and volunteer associations. The work is to be carried out on a basis of the sternest statistical accuracy, so that any charge of sentimentality may be opposed by the dispassionate candor and scientific faithfulness of all its future statements.

The text of the law establishing the Bureau specially mentions that it shall investigate "the questions of infant mortality, the birth-rate, orphanage, juvenile courts, desertion, dangerous occupations, accidents and diseases of children, employment and legislation affecting children in the several states and territories." The problems of the birth-rate and infant mortality are to be taken up first, and the Chief of the Bureau believes that a careful survey of the field, with a summarization and popular presentation of the great mass of more or less uncorrelated facts already collected by various agencies, is the first duty of the Bureau. The necessity for more efficient and complete registration is to be urged upon the several states. Miss Lathrop indicates as fundamental the proposition that to know the birth-rate, as well as the death-rate, we must register the children born. To stop the loss of 200,000 infants yearly we must know when and where and why they die. To know when the nation's children should attend school, or when they may work legally, we must know their ages by legal record.

"The question has been asked if there could be a more satisfying task than that of saving the lives of 100,000 babies every year. Some may think it a more satisfying aim to make certain the welfare of those same children and of every living child. It is only a satisfying ambition to save life if we can see that health, education, recreation, and work are duly secured and harmonized to serve the true ends of life. . . .

"If this Bureau heeds the aspiration of that universal cry of human parenthood, if it really serves democracy, it will survive and grow. If not, it will perish, for that cry is as old and strong as time, as fresh and inevitable as tomorrow. That cry will be heard and will be served somehow, voicing as it does the invincible slow progress of humanity upward."

Clean Milk in Chicago.

"During August an ordinance was finally passed by the city council of Chicago requiring that the milk of the dairies supplying the city be labeled 'inspected' or 'pasteurized,' also, that the general conditions of the dairies be improved. These changes were brought about by the influence of public health committees, after the Legisature of Illinois had enacted a law prohibiting the requirement of the tuberculin test of cows and the city council had defeated an ordinance requiring pasteurized and inspected milk. The death-rate among infants has been remarkably large, the total number of deaths for the summer of 1912 exceeding the deaths of 1911, which was an unusually severe summer.

"Without doubt the passage of the above mentioned ordinance will markedly influence the question of infant mortality as such ordinances have elsewhere."

September, 1912, *Bulletin of Ohio State Board of Health.*

Pellagra.

Besides reviewing briefly many papers on the etiology, symptomatology, pathology and treatment of pellagra, as presented before the Association for the Study of Pellagra at its meeting at Columbia, S. C., October 3–4, 1912, the November 1st number of *Public Health Reports* summarizes the resolutions passed by the association in these words:—

"The belief was expressed that the ultimate cause of pellagra is unknown, but that in view of the incrimination of spoiled corn 'measures should be taken by the proper authorities to prevent its sale and consumption as food.' The conviction was expressed that 'no satisfactory evidence has ever been submitted which shows pellagra to be directly transmissible from man to man; and, in the present state of our knowledge this associa-

tion regards measures of quarantine and isolation for this disease unnecessary and unwise.' The opinion was also expressed that 'there is at present no known specific remedy for pellagra; and any claim made for the specificity of any special therapeutic agent must be accepted with great caution.' Pellagra was recognized in the United States as 'a matter of great importance to the national public health' and approval was expressed of the interest displayed in this disease by the Public Health Service. The hope was expressed that 'the Congress of the United States may appropriate sufficient funds for the continuance and extension of this work.'"

Syphilitic Families.

The *Journal of the American Medical Association* for November 23, in its current literature columns, reports a study by Wolf of the family histories of nine syphilitic women. "Of the 66 pregnancies only 33 viable children were born, and 14 died in childhood; 3 committed suicide at the ages of 12, 20, and 28 years; two were epileptics, and one died after an abdominal operation; 13 are still living, but only two are normal. The others are all feeble-minded, epileptic, hysteric or with other nervous affections." This demonstrates the great share syphilis has in the development of nervous affections and degeneracy. "The data presented show further that the assumption of a nervous predisposition is untenable, for these same parents in later years, after recovery from the syphilis, were able to generate healthy children."

The Bacteriology of Influenza.

"The view that the influenza bacillus is a necessary factor in the production of this disease is steadily losing ground," says the *New York Medical Journal* (November 23, 1912). Many cases presenting the characteristic symptomatology fail to show the presence of the grip bacillus, while on the other hand that organism is found in conditions which fail completely to present the characteristic features of the disease. In a series of cases studied by Curschmann there were found the pneumococcus, the streptococcus and the staphylococcus, without the Loeffler bacillus, in forty-nine out of seventy-seven typical cases, the other bacteria existing in various combinations. There is, in fact, good ground for Leede's belief that "influenza is a symptom complex which may be evoked by different kinds of bacteria, the most prominent of which is the pneumococcus. Hence the need of always being on our guard against pulmonary complications in these cases."

Child Labor Laws.

William E. McKenna, in reviewing W. F. Ogburn's recent book on Child Labor Legislation for *The Public* (November 29, 1912), makes the following statement:—"While conditions are what they are, we shall need child labor laws and it is well to know what laws we have and what laws others have, so that we may improve ours by following the best examples. But to attack the child labor problem at the root we need the radical reforms that will enable the ordinary adult to support his family without the aid of his children." The reviewer gives from Professor Ogburn's book several interesting legislative curiosities, such as the statute which makes a fine of $50 the penalty for perjury, and the law in one or two states which exempts a child from night school, if he is not strong enough both to work and to attend night school.

Model Towns.

Although England is particularly fortunate in possessing several worthy examples of efficient town planning, such as Port Sunlight, Bournville and Letchworth Village, still another town is to fall in line, according to *Progress* for January, 1912. Middletown, a manufacturing center in Lancashire, with a population of 26,000 is the next community to endeavor to give pleasanter and healthier surroundings to the homes of its industrial workers. The estate selected is to be developed along co-partnership lines and several houses have already been constructed to show what can be done toward providing well-built, well-ventilated homes, pleasant to look at and good to dwell in, at a low cost.

A Modern Hospital.

"The city of Cincinnati is building what is expected to be the finest general hospital in the world. It will consist of thirty group buildings, eighteen of which have already been finished, all planned according to the latest ideas of hospital construction. The cost of the plant will approximate about $3,000,000." Thus a writer for the *New York Times* (December 1, 1912) speaks of the new Cincinnati hospital. The work is largely the result of the efforts of Dr. C. R. Holmes, who has agitated for a new structure for many years, and who was finally appointed to make a study of the equipment and construction of the best hospitals in Europe and in this country. A site was finally selected in the suburbs, and the buildings of the corridor-pavilion type erected. Each building is four stories in height and is in itself a complete hospital or ward unit, possessing a roof garden on the fourth floor and being capable of complete isolation, particularly in the case of the contagious group. Dr. H. T. Summergil, of New York City, an expert in this field, will be the superintendent of the new hospital. The *Times* article concludes that "when finished it will stand as a monument to the awakened public spirit of Cincinnati."

Consumptives' Hospital Schools.

"It was in January, 1911, that, according to Arthur Tracy Cabot in the *Atlantic Monthly*, the Boston Consumptives' Hospital trustees closed the home-school where children with open communicable tuberculosis were segregated." Says Mr. Cabot:—

"The chairman of the board, who cast the deciding vote which closed the school, when asked how these patients were to be cared for after the closure of the school, said, 'At day-camps and hospitals,' and declared that it was the intention of his trustees so to provide for them. Under these circumstances it is interesting to know what became of these patients after they were turned out of the hospital school. Drs. Locks and Murphy made an investigation and were able to trace one hundred and fifty-six out of the one hundred and seventy-four cases treated at the school during the year previous to its closure. Of these cases just nineteen or 10.91 per cent went to day-camps or hospitals; ninety-one, or 58.33 per cent went back into the public schools; four, or 2.56 per cent, had died; and the remaining forty-two patients, or 26.92 per cent, had gone back into the community.

"These figures give a striking illustration of the far greater usefulness to the community of a hospital school than of a day-camp or hospital. Only a little more than 10 per cent of the children whose parents are willing to have them attend a hospital school are willing to let them go to day-camps and hospitals. The large proportion of these cases which went back into the public schools, at the risk of infecting well children, is sufficient basis for a serious indictment of the city government that subjects well children, put under its care, to such unnecessary risks."

Survey, November 30, 1912.

Infant Mortality.

In the special report for 1912 of the New York Milk Committee there are discussed the conditions which most fundamentally affect infant mortality. Perhaps the chief of these is poverty, for this condition forces married women to work long hours of labor in unsanitary surroundings, and compels them to live in filthy, overcrowded tenements. The mother is forced by circumstances to artificially feed her infant, and to leave it in the care of neighbors or at the day nursery.

Ignorance is another powerful influence, for the uninformed mother knows nothing of clean milk or of proper feeding and the result, through bad methods of feeding and dirty milk, is the fatal diarrheal disease.

Poverty and ignorance, then, are the two great causative factors, though other agencies are mentioned by the Milk Committee, such as crime, and illegitimacy and summer heat. Illegitimacy is of some significance, for "the figures for England and Wales for 1909 show the death-rate among illegitimate children under one year of age to be 211.1 as against 104.8 for legitimate children—more than twice as high a mortality."

Cleveland's Open Air Schools.

That the open air schools have proved their worth in the battle against the "White Plague" is the conclusion one must reach after reading the article by J. C. Placak, M.D., medical school inspector of Cleveland, as printed in the October number of the *Cleveland Medical Journal*. Facts are presented which prove that the tuberculous and pretuberculous children are greatly improved both physically and mentally. The backward child is made to progress; the general health of nearly all is benefited; scholarship is improved; and there results a remarkable freedom from attacks of tonsilitis, choryza and bronchitis. The development of much tuberculosis is inhibited, some positive cases are cured, and purely from an economic standpoint the measure is justified by the saving of many thousands of dollars yearly to the community. The average gain in weight at one school during the winter was 4.7 pounds; at another school, 5.8 pounds; another 2.9 pounds; and still another 3.2 pounds. Of course, special provisions are made as to diet, the children being fed at 10 a. m., and 2 p. m., on milk, soups, bread, butter, jellies and cocoa. Suitable clothing is provided, consisting of heavy blanket suits, "lumber jack" stockings and felt-lined shoes. The results justify the work from an educational, as well as from a public health standpoint.

Septic Sore Throat.

Public Health Reports for November 22, 1912, in summarizing a report on the outbreak of septic sore throat in Baltimore, March, 1912, among other points, presents the following conclusions:—The outbreak was apparently a streptococcus infection. There were perhaps as many as 3,000 cases, with thirty or more deaths, and the method of dissemination in the epidemic was chiefly through the milk of one of the large dairies, probably augmented and prolonged by contact infection. The milk was probably infected previously to pasteurization and the infective agent survived the inadequate "flash" process employed at the time. As to the source of the infection the most probable hypothesis is that it was derived from the udder of some of the cows which produced the milk.

To quote the report further: "This epidemic can be satisfactorily accounted for only by the failure of the 'flash' system of pasteurization to pasteurize. It is believed that with the exception of the few days early in February, when the pasteurizer was out of operation, the pasteurization process used in the Baltimore dairy was conscientiously applied, and that reasonable precaution was used in the subsequent handling of the milk. The trouble lay apparently in the inadequacy of the process used. It is confirmation of the already widespread belief that the so-called 'flash' system of pasteurization is inefficient, as recently demonstrated by Rosenau and Schorer,[1] and that milk to be rendered safe must be held at a temperature of not less than 145°C. for at least 20 minutes, as recommended by the committee on milk standards appointed by the New York Medical Milk Commission."

Municipal Baby Incubators.

The *Medical Officer* for October 26, 1912, reports the consideration by the Oldham Health Committee of the use of baby incubators under municipal ownership and direction, for the rearing of premature, delicate or neglected infants. The question of the use of portable or nonsportable ones was discussed, and it was decided that they would receive a fair amount of use. A resolution was finally adopted declaring for the purchase by the town of two inexpensive, portable incubators.

Economy, not Philanthropy.

"Business men are learning that well-fed, well-clothed, contented and happy men and women, working in well-lighted, well-ventilated quarters and on schedules arranged in accordance with modern knowledge turn

[1]Rosenau, M. J., and Schorer, E. H.: Tests of the efficiency of pasteurization of milk under practical conditions, *Journ. Med. Research*, April, 1912, Vol. 26, pp. 127–158.

out more work and better work than underpaid, discontented, over-worked help, working under uncomfortable and unsanitary conditions. In many places large corporations are to be found spending money liberally in playgrounds, rest rooms, libraries, gymnasiums, sanitary lunch rooms, moving picture shows, safety devices, ventilating systems and similar undertakings for the well-being and enjoyment of their employés; and this is not charity, but good common business sense."

The Public Health Journal, Toronto, Ont., November, 1912.

Pellagra in New York State.

The September Bulletin of the *New York State Health Board* states that a few cases of pellagra have occurred in that state in the last year or two, one or two of which were in native inhabitants. The disease here is of recent origin, is apparently spreading northward and for these reasons health officers and physicians should become familiar with its manifestations. Two cases have been found in insane hospitals. The bulletin states that there is little evidence to lead to the consideration of the disease as a communicable one. It calls attention to the symptomatological "three D's" of pellagra, namely diarrhea, dementia and dermatitis. The diarrhea is associated with other digestive disorders; the dementia may be melancholia, manic-depressive insanity, neurasthenia, delirium, katotonia or an anxiety psychosis; the dermatitis occurs on the backs of the hands, neck and face, and is of an erythematous or vesicular character.

Trachoma in the United States.

"For some time it has been known that trachoma was present to a considerable extent among our Indians. Clark of the United States Public Health Service during the past summer found many cases on the reservations in Minnesota. These findings were deemed by the Minnesota State Board of Health to be of sufficient importance from a sanitary point of view to warrant the board in giving the matter the most careful consideration with a view of formulating plans for preventing the spread of the infection. Such action was clearly indicated for the protection of the commonwealth, trachoma being a communicable disease, mutilating in its effect, reducing markedly the efficiency of those affected, and, unless properly treated, ending frequently in blindness.

"Recently McMullen,[1] also of the Public Health Service, in an investigation of the prevalence of trachoma in eastern Kentucky, undertaken at the request of the Kentucky State Board of Health, found a most unlooked-for and surprising condition. McMullen carried on his survey in the mountain districts in Knott, Perry, Leslie, Breathitt, Lee and Owsley counties, and in the blue-grass country in Clark County. He examined in all 3,974 people, of whom 500, or approximately 12.5 per cent, were found to have trachoma. Of those examined, 2,796 were school children from the mountain counties, and of these 338, or approximately 12 per cent, had the disease. In Clark County, on the other hand, which is in the blue-grass country, and in which living conditions are quite different from those in the mountains, only fifteen cases of trachoma were found among 436 school children examined.

"The finding of a communicable disease of the nature of trachoma so prevalent in a community places it among the commonwealth's important public health problems. A locality cannot continue heavily infected with such a disease without constituting a serious menace to neighboring uninfected localities even more remote. It is probable, however, the conditions found in Kentucky do not exist in that state alone, but that investigation would show similar conditions present in the contiguous mountain regions of West Virginia, Virginia, Tennessee and North Carolina. McMullen suggests that measures to remedy the condition should be directed toward the prevention of the spread of the disease and the treatment of existing cases. At best, however, the problem is one that will take some

[1] McMullen, John: Trachoma in Kentucky, *Pub. Health Rep.*, November 8, 1912, p. 1815.

time to bring to a satisfactory solution. It will require the utmost efforts of the authorities, assisted by the coöperation of the people."

Editorial (in part) in *Journal of American Medical Association*, November 30, 1912.

Doctor Dowling Reappointed.

"Advices were received from Baton Rouge yesterday to the effect that Governor Hall has reappointed Dr. Oscar Dowling a member as well as president of the State Board of Health to succeed himself. Although this announcement has been anticipated for some time, it is none the less gratifying, as there exists a practically unanimous belief among the people that Dr. Dowling is the best equipped man to head the State Board of Health and that it would be a misfortune to lose his services until the campaign he has inaugurated against insanitary methods and conditions throughout the state has been thoroughly completed.

"Dr. Dowling, although he has served but a few years at the head of the Health Board, having been appointed to fill out an unexpired term, has been one of the most energetic and resourceful health officers the state has known. When he inaugurated his campaign to enforce more sanitary methods in all public restaurants, saloons, dairies, bakeries and other institutions handling the food of the people, there was much opposition from long established interests, but as the sanitary work progressed, and it was seen that it was no mere play to the galleries, but an honest and earnest effort to better conditions and protect the general public from insanitary surroundings, even the people that were originally the strongest opponents of Dr. Dowling applauded his energy and praised the results of his work.

"The appointment of Dr. Dowling to succeed himself reflects credit upon Governor Hall. In this case there can be no suspicion of any political motive nor desire to pay political debts. The governor found the control of the Board of Health in excellent hands and realized the importance of the great work Dr. Dowling had inaugurated, and he has accordingly reappointed him in the best interest of the entire state. No appointment yet made has been so eminently fit and proper, and the *Picayune* accordingly congratulates both Dr. Dowling and the governor, the first because he has received merited recognition and the other because he has made a wise and proper selection of the best man to supervise the state health affairs."

Daily Picayune, New Orleans, November 30, 1912.

Medical School Inspection.

Dr. E. W. Routley of Aldershot, England, is quoted in the *Medical Officer* for October 5, 1912, as declaring for the extension of the schedule of school inspection to include an examination for hernia. The defect is fairly common and is often overlooked, as the undressing of the child is not usually carried to the extent which would reveal its presence. The fear of the surgical operation almost certainly to be advised prevents many parents from mentioning the existence of a hernia, although in a few cases they have been known to call the doctor's attention to the abnormality. "In two cases accidentally brought to Dr. Routley's notice last year nothing would probably have been done in either case if they had not been brought to medical inspection. Both cases were, however, operated on and radically cured."

Health Reform in St. Louis.

The St. Louis Council of Civic Organizations, comprising eighteen bodies working for civic betterment, with a membership of 8,000, proposes to give energetic backing to five bills recently introduced into the municipal assembly, aimed at the protection of the public health. The *Survey* for November 30 gives the measures as follows:—

"For the wrapping of bakery products in clean paper.

"For the sanitary care of tenements, and for running water on each floor of such buildings.

"For the abolition of the 20,000 privy vaults in St. Louis, within five years.

"For regulation of the city's milk supply.

"For the proper heating and ventilation of street cars."

The details of the last bill are interesting. It provides that the air in cars must be changed six times an hour; that the air coming in through the inlets must be of a temperature of at least 60°, and that there must be maintained a temperature of not less than 55° in cars at all times.

As to the removal of the vaults it is planned to displace 4,000 a year and it is estimated that the cost of eliminating the entire lot will be about $1,500,000.

Continuation Industrial Schools.

"Thirty schools in Wisconsin have arranged for continuation schools in which industrial education will be the leading feature. This is the maximum number for which state aid was provided by the Legislature of 1911; other cities stand ready to establish such schools as soon as future legislative enactments shall entitle them to state aid. There has been raised by local taxation in the thirty cities $200,000, while the total state aid is limited to $35,000, and this speaks loudly of the faith of people in the value of providing for the educational needs of those whom the regular schools do not reach.

"As tersely stated by Warren E. Hicks, Assistant Superintendent for Industrial Education, 'Continuation activity is to get instruction in industry, not to get persons out of industry.' In addition to the industrial work, all continuation schools must give instruction in English, citizenship, business practice, physiology and hygiene and safety devices. Regulations have been made to prevent any interference on the part of industrial schools with the regular schools and vice versa. A child must have completed at least the fifth grade before he is permitted to attend a continuation school. Classes made up of part continuation school pupils and part regular school pupils are forbidden."

Wisconsin Educational News Bulletin, October, 1912.

An Innovation in Michigan.

"Gonorrhoea and Syphilis *added to list of reportable diseases.* At the last meeting of the State Board of Health it was decided to place these diseases on the list of those to be reported by physicians to the local health boards and by the latter to the State Board of Health. Special regulation was made, however, that physicians need not report these cases by patient's name but by office number or some other symbol. This is taken to be a step toward more active efforts to restrict the spread of these diseases by instituting restrictive measures for those affected."

Public Health, October, 1912.

City Air Always Impure.

The Air of Large Cities is Always Impure. Every breath inhaled contains damaging quantities of dust and germs. Some idea of the extent of uncleanness of city air may be gathered from the amount of soot which the air contains, although smoke products are perhaps the least injurious of the unwholesome things found in the air. It has been estimated that in the City of New York more than 145 tons of soot are annually thrown into the air by its countless smoking chimneys. Chicago produces nearly ninety tons annually, Philadelphia sixty tons, Pittsburgh, Cleveland, Boston and Detroit about twenty tons each. When we become a little more civilized we will insist upon the application of means to suppress this public source of air uncleanness."

Good Health Magazine, December, 1912.